ERING
JAN 2 2 1946

The Welding Engineer

JANUARY, 1946

THE PIONEER TECHNICAL PUBLICATION OF THE WELDING INDUSTRY

AS the darkness of Global Conflict lightens, the brightness of a world of modernized production illuminates American Industry. Arc Welding, the miracle of war emergency, can and will be utilized by progressive manufacturers in competitive and production problems . . . Arc Welding must be given full recognition for efficiency and economy.

The millions of feet of "**MAJOR**" **WELDING CABLE** used for welding current transmission by the war industries are your guarantee of quality, efficiency, and economy in welding the products of tomorrow!

"MAJOR"

WELDING CABLE

Sizes: 6 to 4/0

Amp: 75 to 550

WELDING ENGINEERING CO.

Manufacturers - Distributors

MILWAUKEE 2, WISCONSIN

Jackson's *Featherlight* A-4W

A Post-War Product for Wartime Use

- FEATHERLIGHT: 50% weight reduction.
- TONGS are of tough light weight alloy.
- COPPER JAWS, quickly and easily replaced.
- INSULATORS: New Crown Type last longer.
- MAINTENANCE: Replaceable Copper Jaws a Crown Type insulators cut maintenance 50
- VENTILATION: Free flowing . . . no holder wo cooler.
- NEW TONG PIVOT-HINGE: Easily knocked do and assembled.
- CABLE CONNECTIONS: Mechanical.
- CAPACITY: ¼" electrodes.

JACKSON PRODUCT

3265 Wight Street, Detroit 7, Michigan

In Canada: Hollup Corporation Limited, Toronto
Paragon Supplies Limited, Vancouver

There's Economy in the Long Run

They are lighter . . . faster . . . safer. Ocean ships and railroad trains are but a few of many things redesigned for modern demands. Our trains travel faster and farther on less fuel. Our planes are winning the war because of this.

Jackson's Featherlight A-4W Holder is another instance of this general trend. It is based on the time-tested principle of tong-type operation and it is fully insulated for safety. Its light metal parts eliminate dead weight. Its streamlined design, its smaller size, its increased lever length all add up to operator appeal and get the job done faster and with less fatigue. And that's what we mean by saying *"There's Economy in the Long Run"*.

T. W.

Designers and manufacturers of fully and semi-insulated electrode holders for every arc welding need, including "Quik-Trik" models TA-1 and 3, with easily detached cable end and the "Quik-Trik" Cable Connector. Complete illustrated folder upon request.

Contact your nearest Jackson dealer or write to us.

E. Engn
Faton

The Welding Engineer

Welding • Cutting • Brazing • Flame-Treating • Metallizing
Design • Construction • Production • Inspection • Maintenance

THE WELDING ENGINEER, with which is consolidated *The Acetylene Journal*

T. B. JEFFERSON
Editor
CLYDE B. CLASON
Associate Editor
DONALD D. HOGATE
Chief, Washington Bureau
HENRY W. YOUNG
West Coast Editor
(621 So. Hope St., Los Angeles 14)

A. M. MORRIS
General Manager
(330 W. 42nd St., New York City)

COPYRIGHT 1946 All rights reserved

THE WELDING ENGINEER PUBLISHING CO.
A Division of
McGRAW-HILL PUBLISHING CO., INC.

EDITORIAL AND PUBLICATION OFFICE:
506 S. Wabash Ave., Chicago 5, Ill.

EXECUTIVE AND SALES OFFICES
330 W. 42nd St., New York 18, N. Y.

The Welding Engineer Publishing Company. Entered as second-class matter January 20, 1916, at the post office at Chicago, Ill., under the act of March 3, 1879. *Subscription rates:* single copy 35c. United States and Possessions, Mexico, Central and South America, one year $3.00, two years $4.00, three years $5.00. Canada, one year $3.50, three years $6.00. All other countries, one year, $6.00, three years $12.00 Please indicate position and company connection on all subscription orders.

FOREIGN REPRESENTATIVES: AUSTRALIA and NEW ZEALAND — R. Hill, Matlock House, Davenport, Auckland, New Zealand; BRAZIL — Alpha Jewel, Caixa Postal No. 2411, Rio de Janeiro, Brazil; GREAT BRITAIN — A. D. Baynes, 1 Cambridge Park Court, Twickenham, Middlesex, England; SOUTH AFRICA — J. W. Arnison, 35a Victoria Avenue, Benoni, Transvaal, South Africa; U. S. S. R. — Mesdunarodnaja Kniga-Kusnezki Most 18, Moscow, U. S. S. R.

A.B.P. Member
A.B.C. Member

A McGRAW-HILL PUBLICATION

VOL. XXXI, NO. 1 JANUARY, 1946

IN THIS ISSUE

ARTICLES

1945—Year of Triumph 35
T. B. JEFFERSON

Explorers under the Earth 38
FRED M. BURT

Elements of Welded Design-1 42
GEORGE L. SNYDER

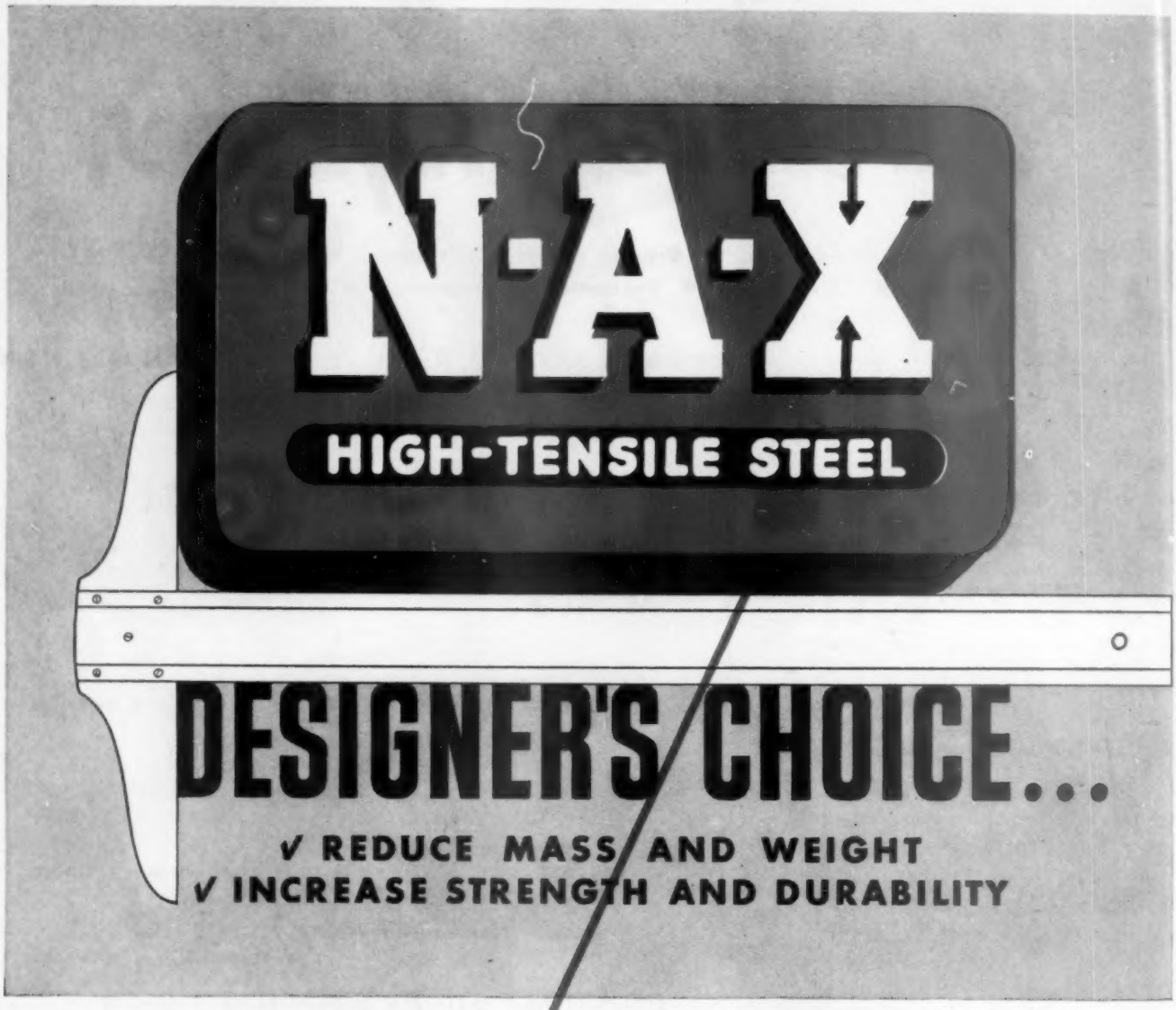
Postwar Resistance Welding 48
J. W. KEHOE and I. A. CRAWFORD

That Versatile Stud Welder 52
CLYDE B. CLASON

Electronic Tracing Widens Scope of Flame-Cutting . 56
WALTER BERGEROW

Salvage by Induction Brazing 78
A. E. ERICSON

Editorial 33
On the Job 62
Short Cuts and Kinks 68
New Products to Use 70
Engineering Data Sheet No. 64 79
News of the Industry 81
About People 86
Helpful Literature Just Published 94
From the Patent Office 100
Classified 111
Advertisers in This Issue 112



By taking advantage of the high inherent properties of N-A-X HIGH-TENSILE steel—great strength and toughness, exceptional formability, outstanding resistance to impact and fatigue, with good weldability and resistance to corrosion—manufacturers can have their choice of two fundamental improvements in product design:

1 Where reduction of weight means efficiency, lighter sections of N-A-X HIGH-TENSILE steel can be used without sacrifice of strength. Its high properties take the place of mass.

2 Where increased strength and life characteristics are desirable, the use of N-A-X HIGH-TENSILE steel in the same sections will provide a stronger, tougher, longer-lasting product.

Certainly these demonstrable advantages are worthy of your consideration in the conquest of postwar markets.

GREAT STEEL FROM GREAT LAKES

GREAT LAKES STEEL
Corporation
N-A-X ALLOY DIVISION • DETROIT 18, MICHIGAN
UNIT OF NATIONAL STEEL CORPORATION
45-NAX-10

Coming Soon!

Visit our exhibit Booth D-621 at the National Metal Show, Cleveland; February 4th to 8th, 1946

THE AIRCO ELECTRONIC TRACING DEVICE

"ELECTRONIC BLOODHOUND"

A *NEW* AIRCO CONTRIBUTION TO MACHINE GAS CUTTING

This electronically-controlled tracing device, designed for use on Airco Oxygraph and Travograph gas cutting machines, points the way to important savings. Applied to machine gas cutting in collaboration with General Electric Company, this "Electronic Bloodhound" assures faithful reproduction with extreme accuracy.

An outline drawing or silhouette, which can be prepared easily and at low cost, is the only guide needed. One drawing or silhouette is sufficient whether one, a hundred, a thousand or more parts are to be cut. The Airco electronic tracing device follows the outline automatically to effect such accuracy of cutting that in most cases further machining is unnecessary.

An explanatory article — "Electronic Tracing Device in Machine Gas Cutting" — will be available shortly. Fill in and mail the coupon for your copy.

This specimen cut shows all possibilities that might arise when machine gas cutting steel shapes — inside and outside square corners; obtuse and acute angles; long slim projections; narrow slots . . . intricate contours, all possible with Airco's new Electronic Tracing Device.

AIRCO AIR REDUCTION

General Offices: 60 East 42nd Street, New York 17, N. Y.

In Texas: MAGNOLIA AIRCO GAS PRODUCTS COMPANY, HOUSTON 1, TEXAS

Offices in All Principal Cities

Internationally Represented by Airco Export Corp.

ORIGINATORS OF MODERN OXYACETYLENE AND ELECTRIC ARC METHODS FOR METAL FABRICATION

WE

Air Reduction
60 East 42nd Street
New York 17, N. Y.

Please send me a copy of the article: "Electronic Tracing Device in Machine Gas Cutting"

NAME_____

FIRM_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

HARRIS

NO. 62A Cutting Torch

Improved Construction and Design

OPERATES easily under most severe conditions. Perfect balance. Oxygen, passing through powerful injector, automatically draws in correct amount of Acetylene to produce positive, neutral flame. Adaptable to either low or medium pressure Acetylene without alteration. Lever affords complete control at all times. Four tips, covering entire range of cutting, furnished as standard. Catalog lists models and connections with prices.

THE HARRIS CALORIFIC COMPANY

CLEVELAND, OHIO

SERVING THE METAL INDUSTRY SINCE 1905

HARRIS

Doubtful "Tips" Seldom Pay Off

(advice that applies to resistance welding, too)

Everything you want to know about Mallory Resistance Welding Electrodes and Alloys . . . materials, properties, dimensions. Send for your free copy today!

IN resistance welding shops, as at racing tracks, a great deal of time and money can be lost by trying to get results with the wrong kind of tip. Correct electrode design is vitally important. But correct design doesn't necessarily mean special design—in fact, the best tip for the job may be a standard electrode!

Since there are standardized designs of pointed, radius, flat and offset tips—and various types of holders, wheels and dies—it's good policy to get expert advice. Mallory is ready to help you anytime—will be glad to begin by sending you free copies of the Mallory Resistance Welding Data Book or of the Mallory Catalog illustrated at the left. Meanwhile, observe these do's and don'ts:

DO'S

1. Use the proper electrode material for doing the job.
2. Use standard electrodes wherever possible.
3. Use the most suitable tip diameter for the thickness of stock being welded.
4. When in doubt, check the Mallory Resistance Welding Data Book.

DON'TS

1. Never use unidentified electrodes or electrode materials.
2. Avoid special, offset or irregular tips when the job can be done with a standard straight tip.
3. Don't use small tips on heavy gauge welding jobs or large tips on small work.

In the United Kingdom, made and sold by MALLORY METALLURGICAL PRODUCTS LTD. (An Associate Company of Johnson, Matthey & Co. Limited) Hatton Garden, London, E. C. 1

P. R. MALLORY & CO. Inc.

MALLORY STANDARD RESISTANCE WELDING ELECTRODES

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

HOLDER for disposable paper cups brazed with EASY-FLO.

MOUNTING GEARS, rollers, sprockets, cams, etc., on shafts or hubs is now being done by brazing with EASY-FLO.

Now-SIL-FOS and EASY-FLO SPEED PRODUCTION - SLASH COSTS ON Reconversion METAL JOINING

AUTOMOBILE universal joint member fabricated with EASY-FLO.

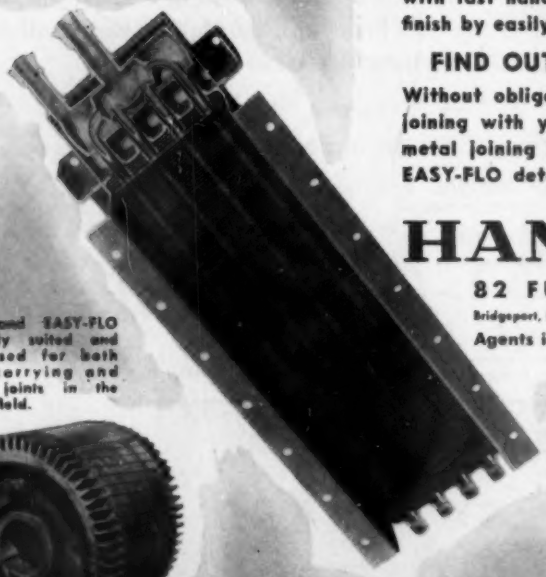
Thousands of manufacturers who learned that *fast production*, one-piece *strength* and surprisingly *low cost* are inherent in SIL-FOS and EASY-FLO brazing, are putting that knowledge to good use in reconversion.

That's why you find these two low-temperature silver brazing alloys doing a wide and diversified range of metal joining in the production of "civilian" and "industrial" goods — automobiles, aircraft, refrigerators, electrical appliances, washing machines, pots and pans, bicycles, radios, lawn mowers, metal furniture, heating and air conditioning equipment and a great number of other metal products.

Many of these products have been specifically designed to get the production-boosting, cost-slashing benefits of SIL-FOS and EASY-FLO brazing.

And many manufacturers are getting these benefits to the fullest extent through application of wartime developments in mass production SIL-FOS and EASY-FLO brazing, featuring preplacement of the alloys in conjunction with fast handling and heating methods, carried through from start to finish by easily trained labor.

HEATER fabricated from copper, brass and steel by EASY-FLO brazing.



FIND OUT WHAT THESE ALLOYS WILL DO FOR YOU

Without obligation, we'll send a field engineer to go over your metal joining with you — or we'll give you our recommendations on specific metal joining jobs if you send us samples. For complete SIL-FOS and EASY-FLO details write for *BULLETIN 12-A*.

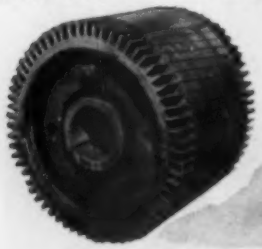
HANDY & HARMAN

82 FULTON ST., NEW YORK 7, N. Y.

Bridgeport, Conn. • Chicago, Ill. • Los Angeles, Cal. • Providence, R. I. • Toronto, Canada

Agents in Principal Cities

SIL-FOS and EASY-FLO are ideally suited and widely used for both current-carrying and structural joints in the Electrical field.



Joining steel stampings with EASY-FLO is giving one auto manufacturer low heating costs, less finishing expense and no warping.

IMPROVED AO

Duraweld Goggles

HELP WELDERS LAY BETTER BEADS FASTER

AO's Improved 404A Duraweld Goggles, fitted with Noviweld lenses, help welders lay better beads faster. New eyecups, anatomically molded for right and left eye, have larger, more comfortable edges; rounded to fit flush against contour of face; allow for greatly increased vision. One-piece adjustable headband resists perspiration, oil, water, grease. Headband fits snugly just above ears and low around the base of the skull.

Ball-chain bridge insulated with plastic tubing, curved slightly for snug, comfortable fit. Easily adjusted to any desired length. Side shields of new design provide increased ventilation; help prevent fogging of lenses. Stray light rays or sparks cannot reach the eyes.

Your nearest AO Safety Representative can supply you from a nearby branch office.

American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS

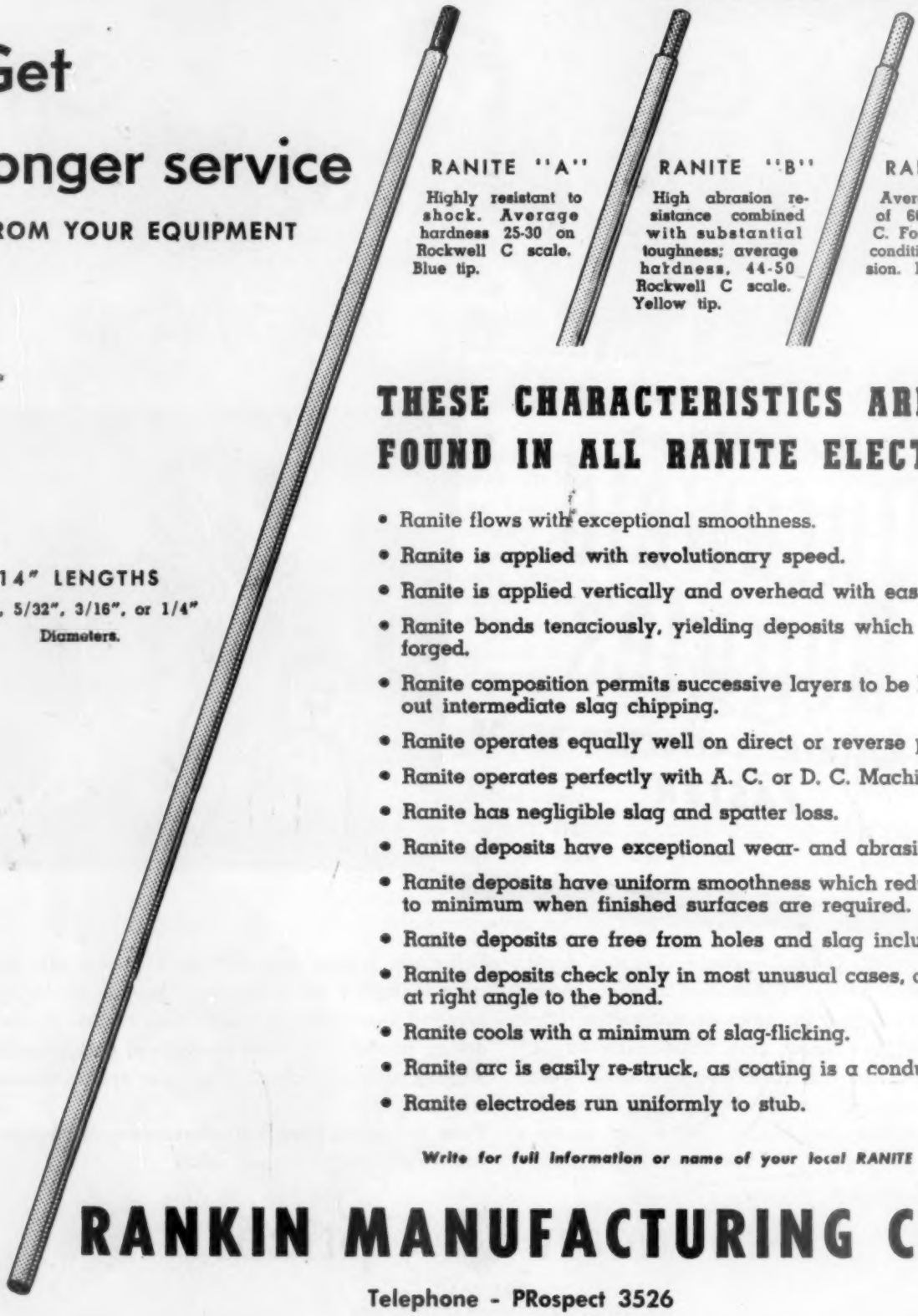
Safety Division

HARD-SURFACE

with Smooth-flowing RANITE

Get longer service

FROM YOUR EQUIPMENT



RANITE "A"
Highly resistant to shock. Average hardness 25-30 on Rockwell C scale. Blue tip.

RANITE "B"
High abrasion resistance combined with substantial toughness; average hardness, 44-50 Rockwell C scale. Yellow tip.

RANITE "C"
Average hardness of 60-62 Rockwell C. For most severe conditions of abrasion. Red tip.

14" LENGTHS
/8", 5/32", 3/16", or 1/4" Diameters.

THESE CHARACTERISTICS ARE FOUND IN ALL RANITE ELECTRODES

- Ranite flows with exceptional smoothness.
- Ranite is applied with revolutionary speed.
- Ranite is applied vertically and overhead with ease.
- Ranite bonds tenaciously, yielding deposits which may be hot-forged.
- Ranite composition permits successive layers to be built up without intermediate slag chipping.
- Ranite operates equally well on direct or reverse polarity.
- Ranite operates perfectly with A. C. or D. C. Machines.
- Ranite has negligible slag and spatter loss.
- Ranite deposits have exceptional wear- and abrasion-resistance.
- Ranite deposits have uniform smoothness which reduces grinding to minimum when finished surfaces are required.
- Ranite deposits are free from holes and slag inclusions.
- Ranite deposits check only in most unusual cases, and then only at right angle to the bond.
- Ranite cools with a minimum of slag-flicking.
- Ranite arc is easily re-struck, as coating is a conductor in itself
- Ranite electrodes run uniformly to stub.

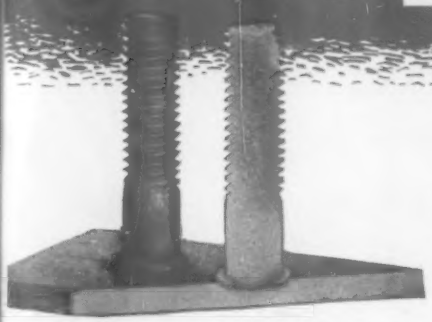
Write for full information or name of your local RANITE Distributor.

RANKIN MANUFACTURING CO.

Telephone - PRospect 3526

3072 W. Pico Blvd. **Los Angeles 6, California**

How to secure electrical parts and wiring without drilling holes



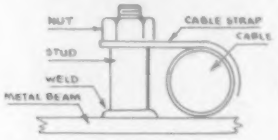
This section view of a stud weld shows how Nelson Stud Welding completely fuses a stud to metal, eliminating drilling holes. And it's all done automatically!

NELSON Arc Stud Welding has been used for years for marine electrical installations and is now available for general electrical construction. Thousands of guns are being used in more than 800 industrial plants and shipyards because stud welding saves *time* and *material*.

Above is a typical Nelson Stud. The pointed end is placed against the metal part and welded with the stud gun. The electrical parts are secured to the threaded end. Studs are manufactured in all standard lengths up to eight inches, in diameters from $\frac{3}{16}$" to $\frac{3}{4}$", and in many types and shapes. It takes less than *one second* to weld a Nelson Stud — operators secure 500 to 1000 studs in eight hours without difficulty.

The Model "H" Arc Stud Welder

The timing and operation are automatic and the use of the equipment is simple. The operator places a stud in the chuck of the gun, places it against the metal, and pulls the trigger. Instantly the arc fuses stud and metal and the operation is completed. A standard welding generator is used.

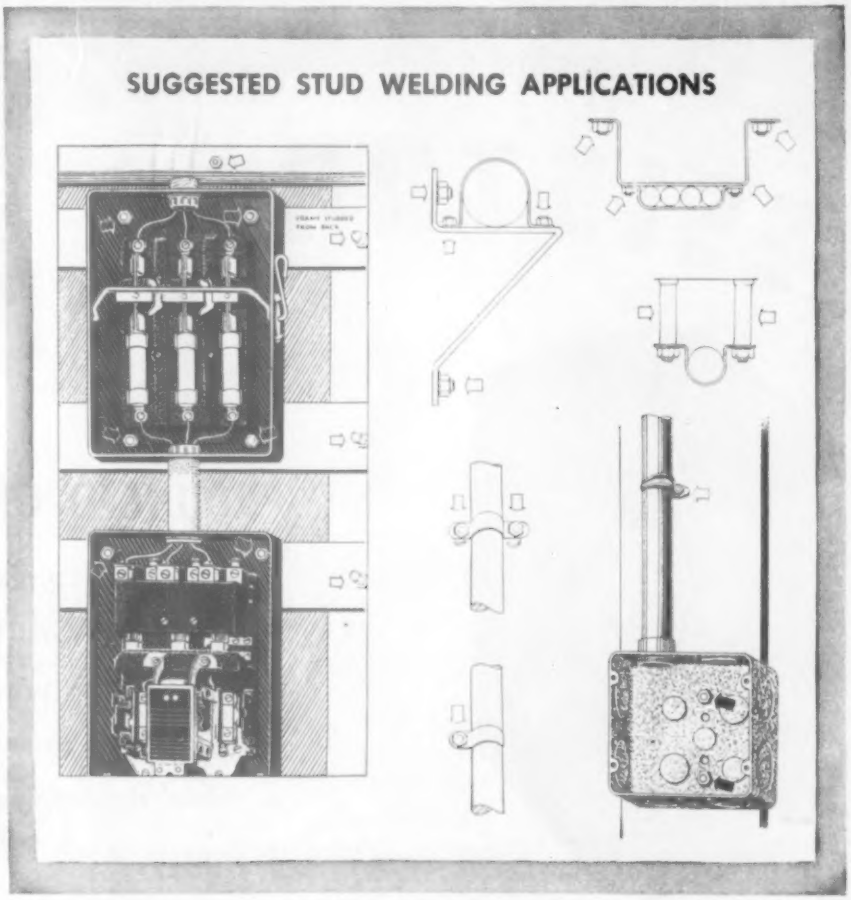


This complete stud assembly *(also see below)* shows the general application. One gun welds all lengths and diameters, producing a full fillet weld in any position. Studs secured by this rapid method equal in strength those secured by any other means.

Switchboxes, outlet boxes, channels and gutters, inspection covers, etc., are also secured easily. For complete details, catalog, and prices, write to:

NELSON SALES CORPORATION
LORAIN, OHIO

Representatives and Distributors for: Nelson Specialty Welding Equipment Corp., San Leandro, California; Nelson Stud Welding Corp., Lorain, Ohio



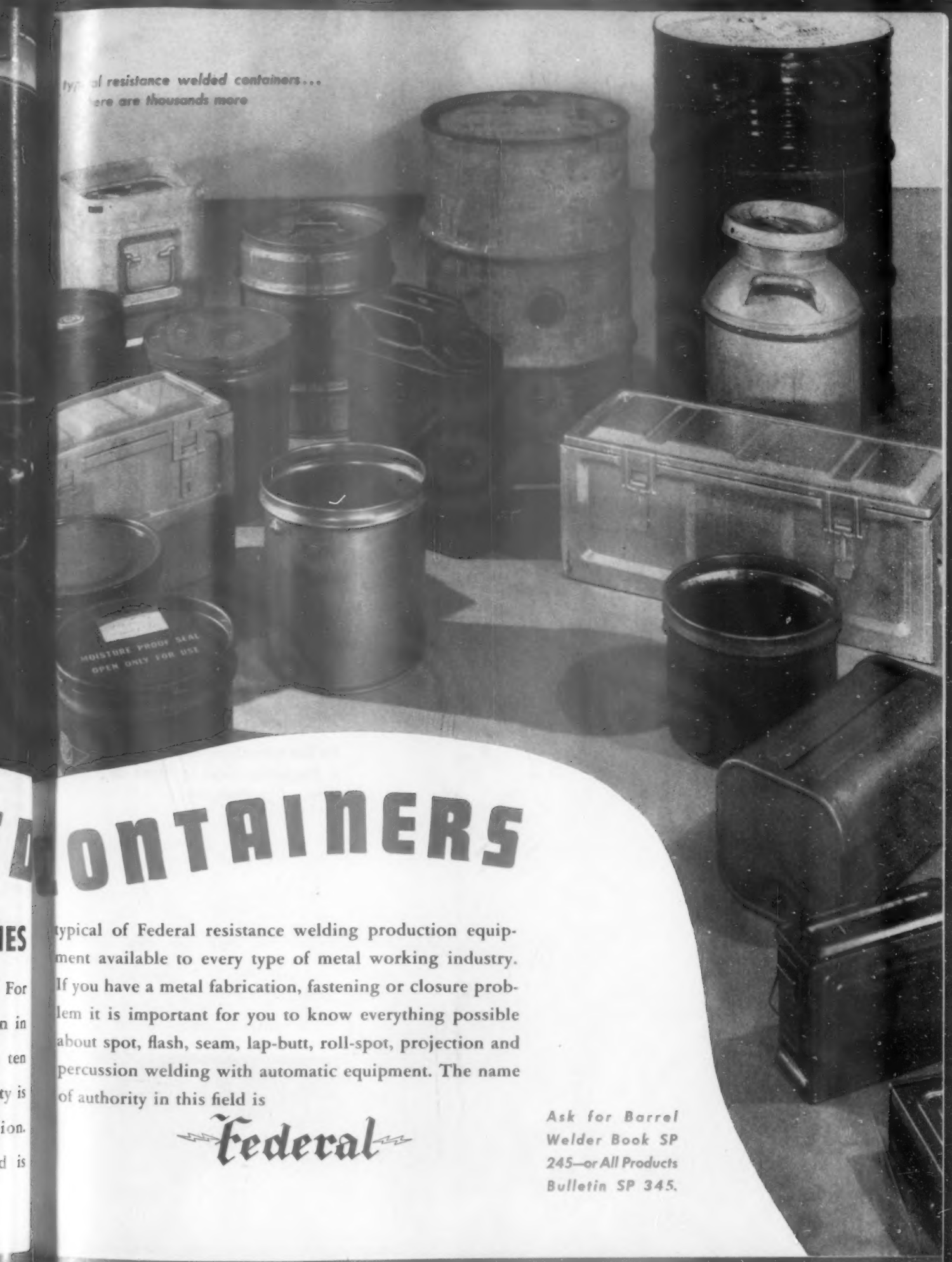
NELSON ARC STUD WELDING

RESISTANCE WELDED

PRODUCED ON FEDERAL MACHINES

are better made . . . more rapidly made . . . at less cost. For instance, the Federal Flash Butt Barrel Welder shown in action above has produced profitably for more than ten years in a modern metal container plant where quality is a prime requirement, along with high production. It delivers 2,500 steel 55-gallon drums daily, and is

federal MACHIN



typical resistance welded containers...
there are thousands more

ONTAINERS

ypical of Federal resistance welding production equipment available to every type of metal working industry. If you have a metal fabrication, fastening or closure problem it is important for you to know everything possible about spot, flash, seam, lap-butt, roll-spot, projection and percussion welding with automatic equipment. The name of authority in this field is

Federal

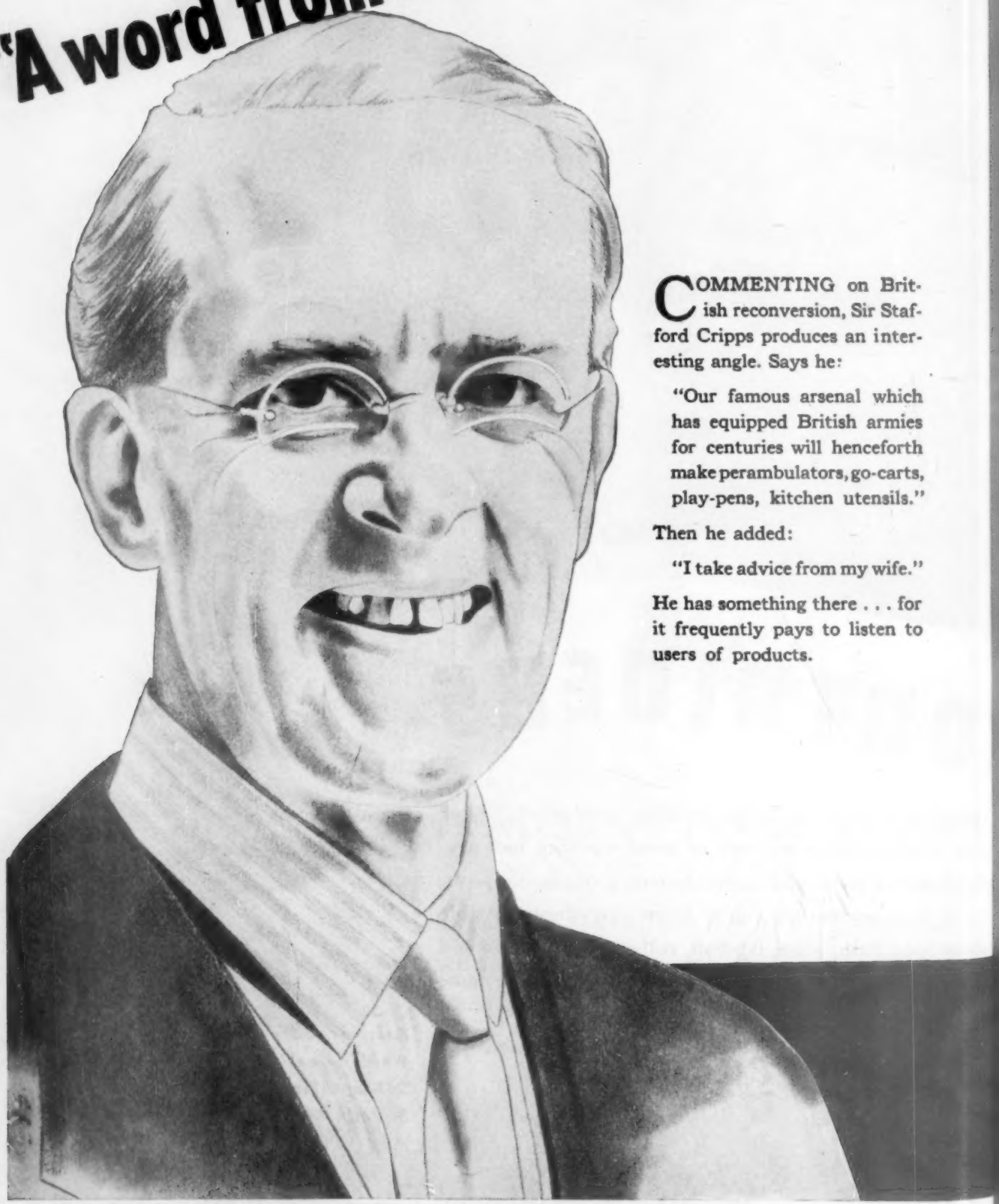
Ask for Barrel Welder Book SP 245—or All Products Bulletin SP 345.

ND WELDER COMPANY

222 DANA STREET
WARREN, OHIO

then he said to himself:

"A word from the wife is sufficient"



COMMENTING on British reconversion, Sir Stafford Cripps produces an interesting angle. Says he:

> "Our famous arsenal which has equipped British armies for centuries will henceforth make perambulators, go-carts, play-pens, kitchen utensils."

Then he added:

> "I take advice from my wife."

He has something there . . . for it frequently pays to listen to users of products.

1945---Year of Triumph

By **T. B. JEFFERSON**

Welding helped our Armed Forces in many ways to wrest victory from the Nazi-Jap enemies of humanity. Welded war materials ranged in size from tiny electronic tubes to battleships. The peacetime outlook appears good, too.

NEVER before was so much history written in so short a time as during the twelve months just passed. Very little over a year ago, the Germans had begun their counteroffensive through Ardennes and were smashing towards Liége with 15 divisions, isolating American units at Bastogne. News commentators were unanimous in their pessimism; the end of the war, said one and all of these gentry, had been postponed by many long months. The backbone of the German drive was broken in just a few days.

MacArthur Invades Luzon

January 9 U. S. Sixth Army troops under General MacArthur landed at Lingayen Gulf just 100 miles north of Manila. On the Russian front Warsaw was captured on January 17 in a brilliant encirclement by Marshal Zhukov's First White Russian Army group.

February saw MacArthur's troops entering Manila and U. S. Marines landing on Iwo Island, 750 miles from Tokyo.

In March an electrifying event occurred: the crossing of the Rhine by General Hodge's First Army and the establishment of the Remagen bridgehead. On March 27 General Patton's Third Army took Frankfort and were racing across Germany, 198 miles from Berlin.

April brought new progress on every fighting front. American troops invaded Okinawa island, inaugurating a bitterly fought campaign 360 miles south of the Jap homeland. Russian forces fought their way into Vienna on April 9 and into Berlin itself on April 22. The U. S. Seventh Army took Nuremberg, shrine city of the Nazi faith.

In the same month two deaths of world-renowned figures occurred, under vastly different circumstances. On April 12 President Roosevelt passed quietly away at Warm Springs, and Vice-President Harry S. Truman became president. On April 28 the in-

Courtesy, General Electric Co.

Not a Fourth-of-July display but a huge fan of flying sparks caused by flash welding as two semicircular pieces of steel are fused into a magnet-frame for a big d-c motor.

Courtesy, The Glenn L. Martin Co.

Pent-up demands for new construction find welded tractors and earth-moving equipment the first items needed on the job. The maintenance welder will be needed there, too.

famous Benito Mussolini, his mistress and 16 Fascist henchmen were exterminated by justly angered Italian patriots.

V-E Day in May

May 1 saw the death of a skunk named Adolph Hitler: the greatest criminal of all times succeeded in sneaking out of the Germany he had ruined via the suicide route. Grand Admiral Karl Doenitz styled himself Fuehrer of the Reich and surrendered Germany five days later. On May 7 the surrender was formally signed for the German Army in the historic red schoolhouse at Rheims, France.

One war was ended; the other continued with no slackening in intensity. June 21 ended the Battle of Okinawa with the island firmly in American hands. On June 26 the World Security Charter was signed at San Francisco by the representatives of 50 United Nations.

July was a relatively unimportant month with one exception: MacArthur's headquarters on July 4 announced the liberation of all the Philippine islands.

August proved to be the climax of the war against Japan just as May had been against Germany. Once again historic events beat against our collective consciousness with the force of machine-gun bullets.

The Atomic Bomb

August 6 brought the announcement of the most important event in world history—at least since the discovery of fire. Atomic energy, deemed by most people a wild dream if, indeed, they thought about it at all, had been unchained. It proved to be even more terrible than the most imaginative of writers had been able to portray it. Hiroshima was virtually wiped out with a single atomic-bomb, and three days later the same fate was meted out to Nagasaki. Russia entered the war, and Japan's fate was sealed. After stalling futilely for three days, the Japanese government radioed its acceptance of Allied peace terms on August 14. On September 2 the Premier and Jap military leaders signed the formal surrender documents on board the battleship *U. S. S. Missouri* in Tokyo Bay.

On October 18 the representatives of four powers—the United States, Great Britain, Russia and France—indicted 24 top Nazis and Prussian militarists with the crimes of instigating the world's worst war and the mass murder of nearly ten million people. Never before were such terrible charges made in human history, and never was there such a trial as the one that opened at Nuremburg late in November and is still continuing.

Against This Background—

A great war was won in 1945, and welding and related processes contributed much to our final victory. Now that the facts can be told, it might be well to review briefly a few items to indicate just how welding helped to make 1945 our Year of Triumph.

First item to mention is our colossal ship program. Welding made it possible to build 10,500-ton Liberty and Victory ships in an average time of 51 days. Some yards even turned out ships every 28 days. When you compare either figure with the 243 days necessary at Hog Island during World War I to build a riveted ship of comparable size, welding's role in the creation of our merchant marine may be accurately judged. The 51 days, it should be noted, is an all-yard average, but the 243 days was the *best* time ever attained for the riveted ships of a war ago.

Courtesy, International Harvester Co

Welding has become important to the farmer. He has found that welded parts are better and that hard-facing means longer equipment life.

This speedily built "bridge of ships" made it possible to get war materials—materials of welded construction in many instances—to England, to Russia, to Egypt, to Algiers and Tunis, to Italy, to France, to the Rhineland and to the South Pacific in time to turn the Nazi-Nip tide in every region.

A War of Weldments

World War II was in truth a war of weldments. Every conceivable item and instrument of war which had any metallic components usually encountered welding some place in its make-up. Welded war materials included the tiny electronic tube in a radio-operated bomb fuse. Going on up the list, bombs, robot bombs, military tanks, invasion barges, etc., were all products of welding, brazing, flame-cutting and flame-treating processes.

Our Army and Navy used weld-

ing in mass production and used it to a far greater extent than did our enemies. Applied to gun mounts, gun motor carriages and other fighting vehicles, welding made possible improved designs . . . war products which weighed less, gave better performance and increased operational safety.

Armor Plate to Railroads

One of the notable achievements of this war was the development of satisfactory techniques for the welding of armor plate. The change from riveted to all-welded structures for tanks and other fighting vehicles afforded improved design, safety and performance. These developments in the welding of high-strength steels will have many commercial applications where weight is an important factor. Peacetime examples that have already appeared are a welded alloy-steel gondola car 6,400 lb lighter than the ordinary gondola car and the fabrication of new sleeper trains of high-tensile low-alloy steels and of stainless steel for the New York Central and other railroads.

The final achiever of victory—the atomic bomb—was also made possible by welding. To go back a ways, welding was important to the construction of all the cyclotrons in this country. True, these cyclotrons contributed very little to the actual manufacture of the bomb material, but the knowledge revealed by early cyclotron experiments showed that the atomic bomb could be taken out of the realm of science-fiction and made a reality.

Welding at Oak Ridge

At both Oak Ridge and Hanford, welding was an important production process. At Oak Ridge alone, more than 1,000,000 vacuum-tight arc, gas and resistance seam welds were made—a total of over 15,000 miles of welding. Welding was the only means by which these vacuum-tight joints could be obtained, and without a vacuum condition the production of atomic bombs would not have been possible. X-ray and magnetic-particle inspection made sure of quality welds.

Another example of the use of welding in the atomic-bomb project was the construction of twelve large tanks—75 ft in diameter by 15 ft high—to store the dangerously radioactive "nuclear debris" that remains after uranium piles have been subjected to neutron bombardment. Further details of this particular job are given on page 62, this issue.

We could continue almost indefinitely to recite the contributions to victory that might be attributed to welding. Instead, however, let us remind the reader that the war made the public welding conscious. Welding was in the newspapers (where it was both discussed and cussed), in the news reels, in comic strips, in feature movies and in many bum jokes over the radio. All through the war, welding was in the public eye, and so the reconversion period now finds a much greater interest in welded products on the part of both consumers and producers.

The manufacturer is turning to welding for peacetime products because he has available the equipment and know-how used in war production. He is also turning to welding because it affords him the opportunity of producing a more durable, less expensive and lighter weight product in less time. All of these factors are important to a manufacturer plagued and bedeviled by high labor and material costs, high taxes and low price ceilings.

More Welding in '46

None of the welding processes will be neglected in our postwar efforts to catch up on civilian production. Of 566 questionnaires returned to THE WELDING ENGINEER in a recent survey, 63.9% said that they expected to use more arc welding, 42.1% that they would use more gas welding, 17.7% more resistance welding. Only 1.5%, 4.6% and 0.9% expected to use less arc, gas and resistance welding, respectively. Obviously, some processes will be more widespread than ever before because of the fuller understanding of their possibilities gained during wartime production.

Technological progress will supplement manufacturing sagacity. Our nation's many research laboratories, both welding and metallurgical, have discovered a wealth of new knowledge regarding metals and the means of welding them. These wartime advances are available to peacetime industry.

Like most other manufacturers, the makers of welding equipment had not fully formulated their postwar plans when peace came. In general, therefore, they have not yet been able to present postwar models embodying radical departures from the conventional designs. Improvements are constantly being made, however, and some of these have gone beyond the experimental stage and are being used.

Flux-Enriched Cutting

The most startling of the year's new developments was an innovation in flame-cutting which makes it possible to flame-cut cast iron, stainless steel, aluminum, etc. This is done by means of a cutting torch which injects a powdered flux into the flame. The flux flame-cutting process has proved quite valuable in recent months, especially in the scrapping of surplus aircraft. It is possible to cut a whole fuselage neatly in two by means of the flux-enriched flame, which quickly slices through the aluminum skin, the shielded cable with its copper wires and through the other metals found in the cross-section of an airplane.

(Continued on page 47)

Courtesy, Air Reduction Sales Co.

Welding and welding fittings simplify piping installations, provide more permanent systems.

★ MAINTENANCE

Explorers under the Earth

Tools to drill oil wells have to be rugged as they take a terrific beating. Hard-facing is a necessity for the cutters of core drills, which are required to plumb the earth to depths of down to three miles.

By **FRED M. BURT**

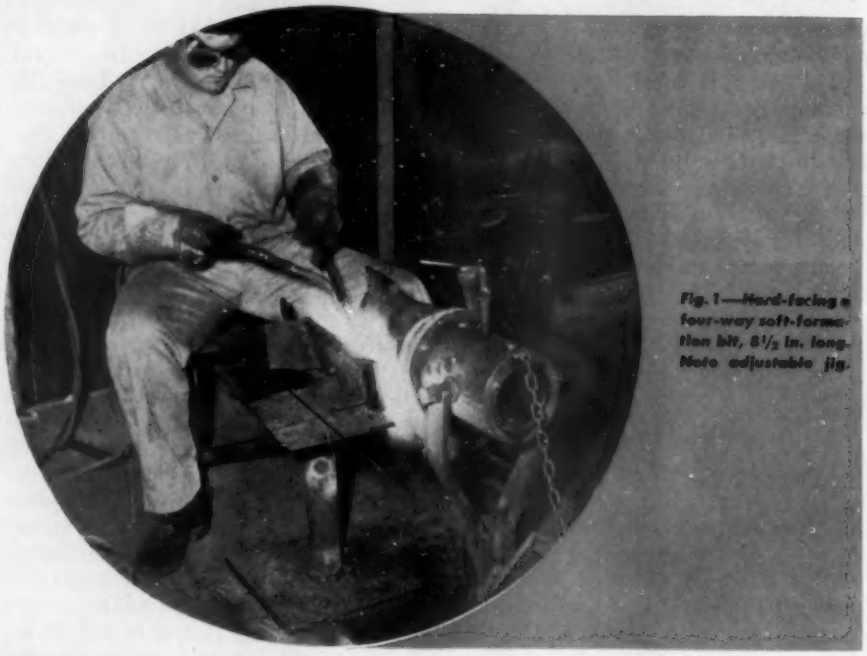


Fig. 1—Hard-facing a four-way soft-formation bit, 8½ in. long. Note adjustable jig.

WELDING techniques play a prominent and necessary part in both production and maintenance operations in the plants of the Byron Jackson Co., Los Angeles. Centrifugal, submersible and turbine pumps are produced in the company's Slausen Avenue unit, while the facilities on Vernon Avenue are devoted to the manufacture of oil-well tools.

They Have to Be Tough

Tools for drilling oil wells have to be very rugged. These explorers under the earth are required to cut, drill and sometimes literally wear holes down through every type of hard and soft formation found over oil deposits—in depths which may range down to three miles plus. The deepest well in the world, 16,246 ft, near Taft, Calif., was drilled with Byron Jackson tools.

The ability of these drills to cut a maximum footage of straight, full-gauge hole before they are dulled is directly dependent on the hardness of the bit cutters. No base metal, cast or forged, will provide the extreme hardness required, so it is necessary to hard-face the cutters with tungsten carbide. This material closely approaches the diamond in hardness, having a hardness reading on the Mohs scale of 9.5 as compared with 10.0 for the diamond.

Prepare Own Hard-Facing

Tungsten carbide is prepared in the company's metallurgical laboratory in 25 lb lots. Tungsten powder, over 99% pure and of 300-mesh fineness (costing about $2.60 per lb), is mixed with the proper amount of carbon in the form of graphite powder. The tungsten and graphite are given a homogeneous, dry mixing in a mechanical mixer and are then placed in a graphite tray, 18 in. long by 2 in. wide. These trays are made by splitting a stock bar of carbon, 3 in. in diameter, and hollowing out the two units thus produced with an end mill. After the mixture has been smoothly and evenly distributed the length of the tray, an operator starts at one

Fig. 2—General view of oil-tool welding department with Foreman Hubert Jenkins at the far left. Oxy-acetylene hard-facing is done on the left, arc welding on the right.

Fig. 4—Hard-faced cutters and cutter parts. Left to right: body in rear, spider in front with arms and pins that hold cutters; body and spider welded as shown in Fig. 3; small core catcher; 8½-in. hard-formation bit with hard-faced core cutters and reamers; two hard-faced roller cutters in front of bit; three-way, soft-formation bit (extreme right) before and after application of hard-facing.

end with a carbon arc and applies this heat from one end to the other to melt the contents into a hard, brittle product, tungsten carbide.

A roller-type mechanical crusher breaks down the tungsten carbide into fine particles, which are separated into lots of differing sizes by being passed through standard Taylor sizing-screens. The end products, as used, are in several mesh-finenesses, ranging from mesh 20 down to mesh 100. These particles are packed in 20-in. long, thin-wall seamless steel tubing varying in diameter (in 1/16 in. steps) from 3/8 down to 1/16 in. The coarser particles are packed in the larger tubes, the others being graded down to the 80-100 mesh tungsten carbide in the 1/16 in. tube.

Torch Tip Orifices

The reason for the difference of particle and tube size is to provide properly graded tungsten carbide for the particular application. The operator uses an oxy-acetylene torch (Fig. 1) with a tip in proper size in relation to the thickness of the hard-facing desired. Hard-formation bit cutters are hard-faced using tips having orifices varying from No. 49 to No. 30 drill sizes (0.073 and 0.1285 in. respectively). The No. 49 drill size tip (0.073 in.) is most commonly used. The soft-formation bits are hard-faced more often with a tip having a No. 30 drill size orifice, with the range extending from No. 43 (0.089 in.) to No. 29 (0.136 in.) drill sizes. Additional torch data are given in Table I.

Table I. Torch Data for Hard-Facing Cutter Bits

Metal Thickness, In.	Tip Drill Size	Average Length of Inner Flame Cone, In.	Oxygen Pressure in Psi		Acetylene Pressure in Psi		Hourly Gas Consumption	
			Min.	Max.	Min.	Max.	Min.	Max.
1/8- 3/16	53	3/8	3	7	3	7	8	36
3/16- 1/4	49	5/8	4	10	4	10	10	41
1/4- 1/2	43	1	5	12	5	15	15	59
1/2- 3/4	36	1 1/8	6	14	6	15	55	127
3/4-1 1/4	30	1 1/4	7	16	7	15	78	152
1 1/4-2	29	1 1/4	9	18	8	15	81	160

The cutters and bits are made of SAE 4820 (molybdenum) steel, and the work is done by two men, each of whom hard-faces the two types: hard-formation and soft-formation bits and cutters. The job shown in Fig. 1, hard-facing a four-way 8½ in. soft-

Fig. 3—The welder below is joining the spider of a hard-formation bit to the body. The spider carries the two sets of double roller cutters.

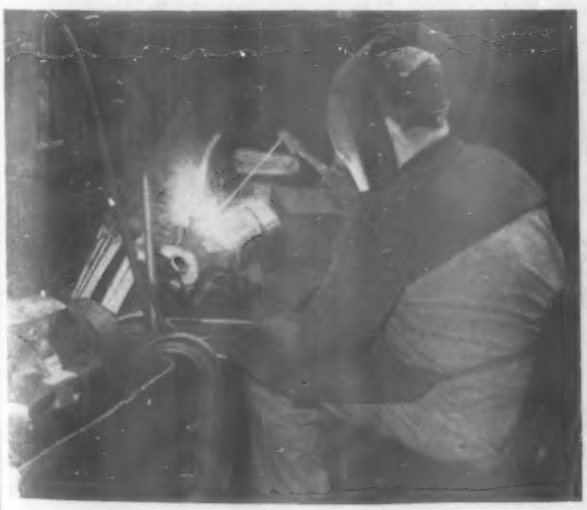


Fig. 5—Hard-facing 18-8 stainless-steel pump sleeve. The sleeve is slowly revolved on the fixture while the hard-faced deposit is applied by oxy-acetylene welding

OUTER BARREL — 1 QTY. — 196754

36-2156 Spec. Rough Dwg.
3F-1521 Std. Fin. Dwg. C.S.

		Inspection - Obtain specimen for Metallurgical test, deliver to Lab. at Vernon.
1	MM	Machine for nozzles - lay out for feet.
		INSPECT
2	Fl	Bolt in end plate - fit feet.
3	Weldors	Tack weld end plate only - weld feet
4	Floor	Locate nozzles complete
5	Weldors	Weld nozzles complete
6	O.T.	Preheat - weld end plate - stress relieve
7	MM	Finish machine complete
8		Drill
		INSPECT
9	Cleaners	Clean
10		Hydrotest
		Build

ASSEMBLY

DATE FIN. | QTY. REP. | QTY. SPOIL | QTY. OK | FINAL INSP

Fig. 6—Route card used at Byron Jackson to schedule operations on the outer barrel of a centrifugal pump.

formation bit, is about a two-hour operation. In this picture, note the ingeniously designed adjustable holding fixture and shield.

Fig. 2 shows the oil-tool welding department. Foreman Hubert Jenkins is at the far left; back of him is a weldor doing hard-facing and at the right is the arc-welding department. The arc weldor is the same man shown in the close-up, Fig. 3. The company has eight arc weldors, four each on day and night shifts.

Roller Cutters Self-Sharpening

The weldor shown in Fig. 3 is welding the spider of a hard-formation bit to the body. The spider carries the two sets of double roller cutters, which revolve on pins (welded to the spider). One set is the core cutters (Fig. 4), which drill out the core of the oil-well hole, and the other set is the reamer cutters, which enlarge the hole to the desired diameter. Roller cutters are hard-faced on the leading edges only—a procedure which keeps the cutting edges sharp until they have worn down to ineffectiveness. Although the cutters and all bearing parts are of special alloy steel, fully heat treated, they are much softer than the tungsten-carbide hard-facing. As the latter wears down slowly, the base metal backing it also wears down, thus maintaining the sharp edge. If the edge were hard-faced on both sides, it would soon wear to a rounded shape having poor cutting qualities.

It may be interesting at this point to consider the manner in which a core drill operates. The pieces of formations cut away are carried up with mud inside the cutters. The mud passes out through side holes and returns downwards, while the cored formation particles pass up through spring-type core catchers, also shown in Fig. 4. This manner of flushing the cuttings off the bottom eliminates the regrinding of formations already cut. The core catchers act on the principle of a check valve. Passing above them, the formations enter the inner barrel of the core drill, which is sufficiently long to permit the taking of cores 10 ft or more in length.

Whenever the drilling speed slows down to a point indicative of dull bit cutters, the bit is removed and replaced by a new one. The worn cutters are then sent to Byron Jackson to be hard-faced.

Oxygen and Acetylene Supply

Hard-facing on this broad scale necessitates the consumption of large amounts of oxygen and acetylene. All of the oxy-acetylene welding stations in the 36 by 40 ft enclosure are supplied by pipe lines. Lines painted red carry acetylene gas, green ones oxygen. Oxygen is supplied from a central manifold. There are two sets of five oxygen cylinders, each containing 220 cu ft at starting pressures of 2,000 psi at 70 F. One manifold is used until the cylinders fall below working pressure; then the other set is cut in. A master regulator is used to cut the cylinder pressure down to proper working pressure—40 psi. Gauges show pressure from the cylinders and the line pressure; there are also individual gauges at each working station to show both oxygen and acetylene pressures.

Acetylene gas is generated and piped from an outside brick building. The latter has a loose roof and brick walls 10 in. thick as well as a similar dividing wall separating the 6 by 10 ft carbide storage room from the 8 by 10 ft room which houses two acetylene generators. One generator at a time supplies the feed line and will maintain pressure for about six hours. Each holds 150 gallons of water, which is piped in by turning a valve at the start of the operation. When an overflow shows the tank to be full, 150 lb of carbide (1½ cans) are poured in through a top funnel. Carbide particles drop into the water until the proper acetylene pressure (about 13 psi) is built up, when a valve closes to prevent the addition of further carbide until the pressure drops. When the operating generator is nearly exhausted, the second one is started, and the carbide-laden water is carried away from number one through a 2½-in. pipe. The gas produced is carried to the welding department in 2-in. lines and distributed there in the 1-in., red-painted service lines.

While much renewal build-up and other diversified welding is done in this department, the hard-facing of bit cutters is the principal production work. There is another, completely equipped, welding station in the forging and heat-treating section for all kinds of general service work with arc and oxy-acetylene welding, flame-cutting, etc. Quick service is given on

Fig. 7 — Welding on the centrifugal pump outer barrel. This large forging has been bored and reamed to a 22-in. diameter, leaving a shell 2⅜ in. thick. The plate suspended by the chain will be fitted in and welded to the end of the barrel by means of a heavy circumferential weld.

all the kinds of welding that are required in repair and maintenance work as well as for corrective welding to put defective units in proper shape and anything else that turns up.

Among the diverse welding operations in the pump division is the hard-facing of 18-8 stainless-steel pump sleeves with a cobalt-chromium-tungsten alloy. The oxy-acetylene method is used here also, and a hard-facing deposit about $\frac{1}{16}$ in. thick is laid as the sleeve is slowly revolved on the special holding fixture shown in Fig. 5. After hard-facing, the sleeves are ground to precise dimensions and proper finish on external grinders.

Outer Barrels of Pumps

The route card showing the operations on the centrifugal pump outer barrel is reproduced in Fig. 6. This large forging (Fig. 7) has been bored and reamed to a 22 in. diameter, leaving a shell $2\frac{5}{8}$ in. thick. The completed barrel is built to withstand a pressure test of 3,500 psi, with an adequate margin of safety above that. The background end has a flange to which a removable cover is bolted. The plate shown suspended at the near end of Fig. 7 is fitted in and tack welded. The circular gap, milled on a horizontal mill (HM), is filled in by arc welding; this gap is outside the points of contact of the barrel and end plate when the two units are fitted together. The welding is done with AWS E-6010 mild-steel electrodes while the barrel is being revolved manually on rollers. The heavy weld deposit makes the end plate an integral part of the barrel. The feet are then welded on, as illustrated by the operations of the weldor in Fig. 7, and the suction or intake nozzle (close to the end plate) and the discharge nozzle (back of it) are similarly welded in place. The whole welded unit is given a stress-relieving heat treatment before finish machining.

In another type of centrifugal pump (Fig. 8), an 18-8 stainless-steel liner $\frac{1}{16}$ in. thick is welded to the inner circumference of the barrel. The entire lining has $\frac{1}{2}$-in. holes drilled 2 in. apart in staggered arrangement. This welding is done on the same roller fixture shown in Fig. 7, with both ends of the barrel open. The attachment of liner to barrel is made by plug welding the holes with stainless-steel wire, and subsequently machining for dimensional finish. The end plate is similarily lined with a perforated stainless-steel liner before it is attached to the barrel.

The main liner of the barrel extends nearly to the large circumferential weld (shown in Fig. 8) attaching the end plate to the barrel; the liner terminates at an inside peripheral shoulder, which is weld-coated with stainless steel. In the narrow space between the shoulder and the end plate, another, quite narrow, liner of stainless steel is welded to the barrel with the same plug-welding technique. The outer edges of the barrel and end plate are milled at the point of juncture to form a deep U-shaped channel extending around the circumference when the two units are fitted and tack welded together. This gap is filled in by arc welding, providing a union of the great strength necessary to withstand the tremendous pressure developed when the pump is operating at capacity.

Method of Pump Operation

The liquid enters the pump through the intake or suction nozzle shown near the end of the barrel. From here it passes into the volute case inside the barrel. The first runner or impeller causes the liquid to flow to similar runners through longitudinal passages, so that the increase of pressure or pumping will be in even balance from end to end of the pumping area. The combined action of all of the impellers builds up a tremendous but even pressure in the liquid, which passes into the space between the inner volute case and the outer barrel and from there is directed out through the discharge nozzle. The outer barrel may be likened to the skin of a banana under tension with the inner volute case as the meat under compression, although without the close fit of the banana skin. The pump illustrated in Fig. 8 is designed to be gear-driven by an 1,100-hp engine and has a pumping capacity of 800 gpm at 1,825 psi. Two units will normally operate in series, delivering 800 gpm at 3,850 psi. The pump is tested up to 5,600 psi.

Other applications of welding and allied techniques in the Byron Jackson plants are too numerous to cover in detail. The wide range of types of pumps, mostly of special design to meet specific needs, are largely for heavy-duty service. Therefore most of the welds are fairly heavy and must be very sound.

In the development of oil tools, a procedure backed by the experience engendered in the 73 years of the Byron Jackson Company's existence, full advantage is taken of field experience, of metallurgical experiments and of the work accomplished on a test drilling rig. Better materials have been found; safety factors have been increased, and excessive weights have been eliminated. All of this has resulted in a material increase in the useful service life of the entire line of tools. Welding has played an important part in these developments.

Flame-Hardening Also Used

In addition to hard-facing, the flame-hardening process is employed on parts subject to unusual wear or to constant impact as a result of their use with other equipment ordinarily harder than themselves. The tool to be flame-hardened is heated locally at the desired points with an oxy-acetylene flame, and then subjected to a suitable quench. An extra-hard surface is thus established without changing the chemical composition of the steel. Parts are hardened only where extra hardness is required, and the depth of hardness may be perfectly controlled. The tough, more ductile metal below the surface is not affected by flame-hardening.

Fig. 8—Another type of centrifugal pump. Note the large circumferential weld which joins the barrel to the end plate. Both barrel and end plate are lined inside with stainless steel, attached by plug welding.

★ DESIGN

Elements of Welded Design*

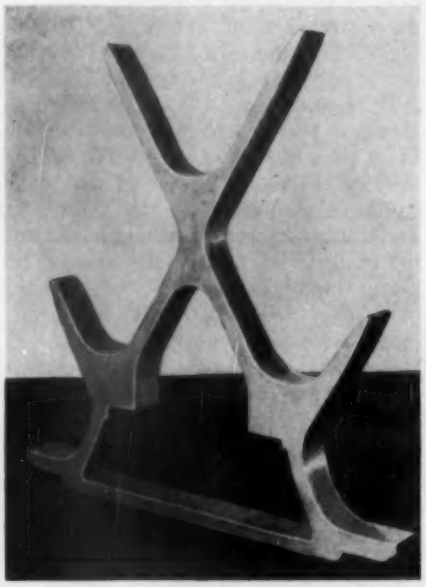


Fig. 1—A component flame-cut to shape from hot-rolled plate.

★ Part One—This two-part discussion of basic design considerations for welded machinery frames takes up such factors as flame-cutting vs. shearing, bending and other forming operations, preweld machining, etc.

By **GEORGE L. SNYDER**

Chief Engineer and Assistant to General Manager, Lukenweld, Inc.

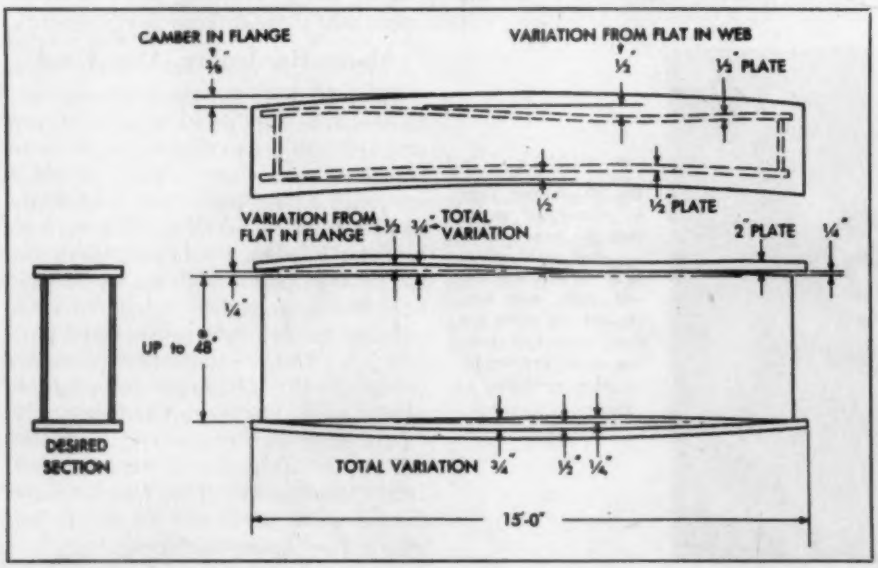
Fig. 2—A plate component shaped by both shearing and flame-cutting.

BECAUSE of the wide scope of the subject, only basic considerations for the designer engaged in developing weldments are brought out in this discussion. Separately, these considerations may seem elementary and self-evident, but when they are considered collectively their complexity becomes apparent. At least 12 different types of components can be utilized by a designer, and each of these components can be used in several ways.

These are the factors to be discussed here. The discussion, however, is limited to dynamically loaded welded machinery parts. Statically loaded welded structures, it should be noted, present a design concept that is decidedly different from that of dynamically loaded structures.

To begin with, a basic element, hot-rolled steel plate, is probably the most universal component used in welded machinery structures. Undoubtedly, the freedom offered by the many sizing and shaping possibilities of hot-rolled steel plate has much to do with its widespread use as weldment components. Basically flexible from the standpoint of dimensions, hot-rolled plate may be obtained in sizes varying up to 195 in. wide or up to 25 in. thick.

Fig. 3—Drawing of box beam showing camber and flatness tolerances. Though highly improbable, such a difficult accumulation of tolerances could occur within the limits of necessary commercial tolerances on flatness and straightness.



Producing Flat Components

Shearing is usually the most economical method of sizing or shaping a plate to rectangular or circular dimensions. But when a plate is to be sheared to size, the designer should keep in mind the existence of "shear droop"—the abrupt break in flatness that occurs around the sheared edge because localized stresses imposed by the shearing pressure exceed the elastic limit of the material. This effect is confined to the area adjacent to the edge, and it can be practically

* Abstract of a paper prepared for presentation at the annual meeting of the American Society of Mechanical Engineers, New York City, Nov. 26—29.

Fig. 4—The main structural parts are premachined on this welded V-type 16-cylinder Diesel-engine frame.

disregarded when the component is to be subsequently trimmed or when it is in light plate, ⅜ in. and under.

Flame-cutting, undoubtedly, is the most common method of shaping and sizing weldment components, particularly when the number of duplicate weldments required is small. Probably a big reason for its popularity is the fact that many components of weldments are necessarily irregular in shape.

Since regular configuration generally is cheaper, the designer should think in such terms wherever possible. However, he need not be concerned whether an edge is sheared or flame-cut as long as he designs the part so the supplier is free to use either method or both on a particular component. Fig. 1 shows an example of a component produced entirely by flame-cutting, while Fig. 2 is a plate part produced by a combination of shearing and flame-cutting.

In addition to shaping and sizing, the cutting torch is also used extensively to make welding chamfers or kerfs on the edges of a component to provide the grooves for welds other than plain fillets.

Tolerance on components merits careful consideration by the designer of weldments, for an accumulation of tolerances can cause costly difficulties in fabrication. The drawing of the box beam (Fig. 3) pictures a highly improbable coincidence of tolerance accumulation. Nevertheless, the condition could occur within the limits of necessary commercial tolerances on flatness and straightness.

Tolerances are important considerations on flatness and straightness, particularly if the fabricator's facilities for performing such operations cannot be operated as cheaply as those of the supplier.

Prefabrication Machining

It is often advantageous to size components with machine tools, if only for the reason that much closer tolerances are obtainable. For a complicated assembly with much welding on it, prefabrication machining is indicated. At times the machining of components will help achieve close tolerance on a complete weldment. The more generous the tolerances on components, the more prevalent the gaps in fitting. Gaps require the deposition of a greater amount of weld metal, thereby increasing costs and destroying the metal-to-metal contact which resists tendencies to shrink or warp.

The main structural parts of the weldment shown in Fig. 4 are premachined. Since this is a mass-production item, individual peculiarities in each weldment caused by the nonuniform accumulation of component tolerances could not be allowed.

Sometimes design considerations dictate prefabrication machining. Another reason, particularly important in the welding of thick plates, is to provide economical welding kerfs in combination with good joint fit-up. A kerf must provide sufficient width to clear the tip of the electrode in order to permit the deposition of weld metal at the root of the weld. As the plate thickness increases, so does the amount of metal wasted in V-shaped flame-cut kerfs in comparison to machined U-shaped ones (Fig. 5).

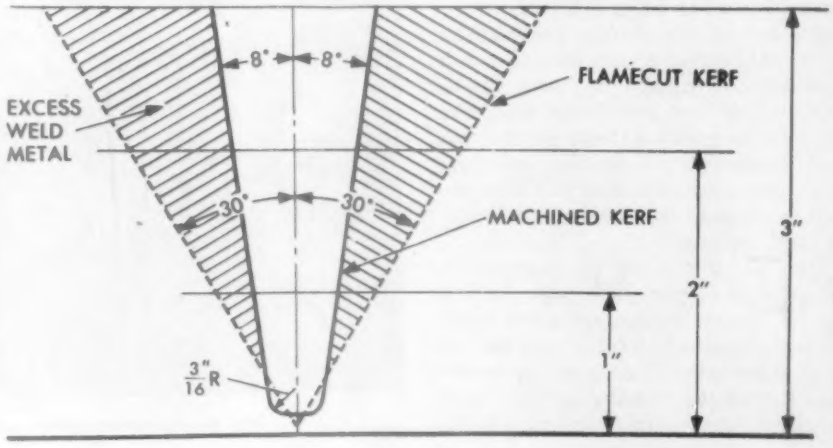
Prefabrication machining is also necessary in instances of conflicting tolerances, in the fitting of circular components within each other. Studies of minimum tolerances reveal that gaps between pieces so fitted are inevitable, but machine fits reduce such gaps to a negligible point.

At other times prefabrication machining is necessary to provide proper contours in highly stressed weldments or in those subject to fatigue. Fig. 6 shows one such instance, the cylinder of a hydraulic press.

Another method frequently used for shaping plate components is blanking or punching on a power press. This operation is simply shearing, using knives of special shapes. It can be justified, usually, only when the quantities required warrant the expense of dies.

A simple example of blanking or punching is the shearing of a rectangular plate. Only one operation is required for blanking in comparison to the four operations which would be necessary to shear each plate. Hence a comparison of blanking and shearing costs can be made

Fig. 5—Comparison of V- and U-shaped kerfs. The U shape steadily becomes more economical from the standpoint of weld-metal deposition as the thickness of the plate increases.



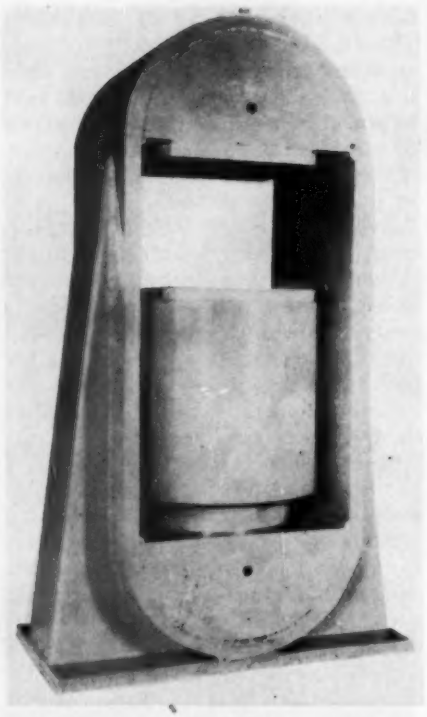


Fig. 6—Hydraulic press cylinder premachined to provide proper curved contour at the corners.

merely by multiplying the cost of the added three shearing operations by the number of pieces required and comparing this with the cost of tooling. Naturally, the relative cost per hour of the machines used might affect the comparison. Another important benefit to be gained by blanking is the comparatively close tolerance that can be achieved.

Formed Components

So far we have considered only flat pieces, but we must also give thought to formed components as these are required frequently in weldments. There are definite reasons for forming operations such as bending or flueing. One is lower cost: angular bends eliminate one or more welded joints, and the cost of bending seldom equals that of the alternative assembly-and-welding. Careful examination of the design proportions of metal sections might show the economy of using the same metal thickness of web and flange to utilize the advantage of a bent section. A bent component, naturally, is more rigid than a flat one, and this fact can be important in the control of shrinkage and warpage.

One of the forming methods in general use is press bending, used in Fig. 7 to make horizontal angular bends. Another method often of value is the specialized forming operation known as flueing. The flued openings shown in Fig. 8 provide formed seats for covers. Generally, such a cover is designed to be fastened by an inner clamp. Treatment permitted by the flued opening eliminates assembly, welding and consequent warpage, and the cost of many drilled and tapped holes. In addition, weight reduction is achieved.

Another function of flued openings in weldments is to provide stiffening lips, which are executed normally by welding a band around the opening.

Since dies are necessary, flued openings are unwarranted economically unless the quantity of openings justifies their use. When flued openings are being considered, the designer should consult the fabricator, for it is possible that dies exist which can be adapted.

Flanging and Bending

Products of flanging or spinning machines are often utilized to advantage in weldments. The bottom rounded ends of the melting pot in Fig. 9, for example, were secured by a flanged head split in half, one-half serving as a portion of each end.

The use of flanged products may provide rigidity, possibly simpler welding conditions or a reduction in the amount of welding. Flanging also provides curved contours, which may be desired for proper functioning or for appearance.

When quantities justify, formed components produced in special shapes by forming dies on power presses may be used advantageously. Bending rolls also provide a useful method of shaping cylindrical contours; a component formed in such a manner is shown in Fig. 10.

Shapes, Castings, Forgings

Shapes formed on a rolling mill may at times be used justifiably in weldments. Their value as components results from two factors: (1) a reduction in cost because of elimination of welding and (2) initial rigidity which can tend to simplify fabrication problems of shrinkage and warpage. If the use of structural rolled shapes is being considered, the tolerances possible should be carefully studied, for they may affect adversely the design requirements.

Steel castings are used extensively as components in weldments where economy in producing complicated shapes or special contours at given points is involved. The physical and chemical properties of such castings should be specified carefully. Also, where size permits, it is desirable to have castings of electric furnace steel —it seems to possess greater cleanliness, and this is important in obtaining good welds with a minimum of difficulty.

Drop forgings may also be used when the size and quantity required justify the investment in dies. This product has good homogeneous prop-

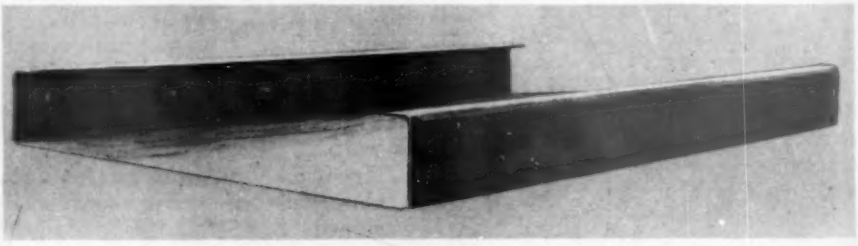


Fig. 7—Horizontal angular bends provided by press bending.

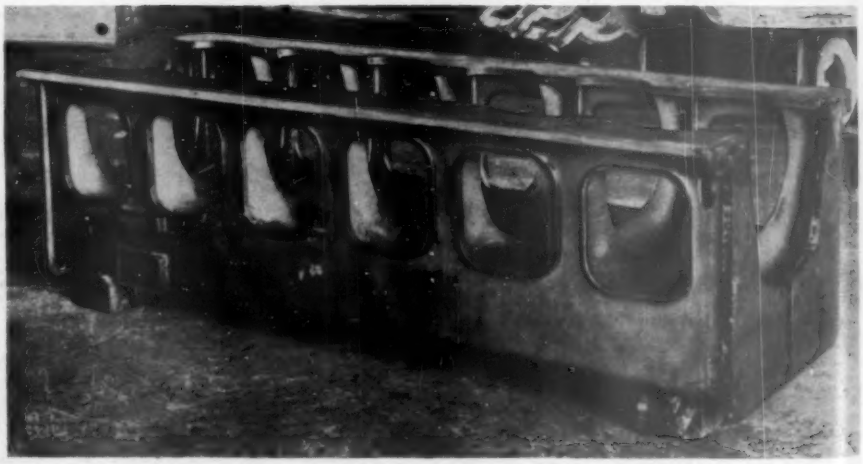


Fig. 8—Utilization of flued openings is shown by this weldment.

erties, and, when properly controlled, its tolerances are close.

Fabrication of Weldments

Leaving the production and application of components, we shall next discuss the subject of fabrication from the viewpoint of the designer who is developing the weldment. His first consideration must necessarily be the type and extent of equipment available in the weldery which will produce the pieces he designs. Obviously, the more flexible and extensive the equipment, the more freedom there will be in design. In addition, when quantities are involved, advantage may be gained in designing the job to suit the particular facilities of the weldery. Usually, it is well to consult with the engineering staff of the weldery regarding these matters, particularly if repetitive items are contemplated.

Production methods concerning the fabrication of weldments may be considered from two aspects: "universal" and special. The first involves the extent of facilities such as positioners, automatic welding units, inspection methods, stress-relieving furnaces, etc. The second aspect involves the use of special jigs or fixtures or other types of tooling that might be justified or imperative. Usually, the possibilities in special tooling should be considered if the product is to be any degree repetitive in quantity.

To promote economy and quality, the designer should also consider the possibility of breaking up the weldment into subassemblies in sizes to suit available positioning equipment. If the final size of the part exceeds the limits of available equipment, possibly it can be redesigned so that a minimum of handling in the final size is necessary. The use of automatic-welding equipment often merits a thought, especially in view of the advantage such equipment offers for cost reduction.

Even with special tooling and despite measures that might be taken to minimize tolerances, the designer should keep in mind that he is still dealing with rough component parts. Weld shop tooling is naturally more restricted than that usually available in machine shops. Hence jigs or fixtures should be designed with the necessity of flexibility in mind.

Special tooling may sometimes be mandatory in order to hold the components in proper relation to each other during welding.

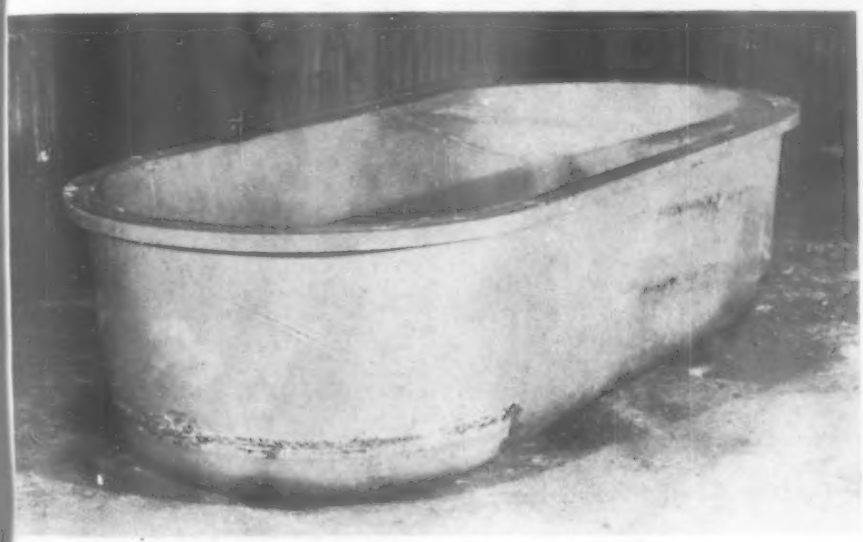


Fig. 9—A flanged head was split in half to provide the bottom contour of the ends of this melting pot.

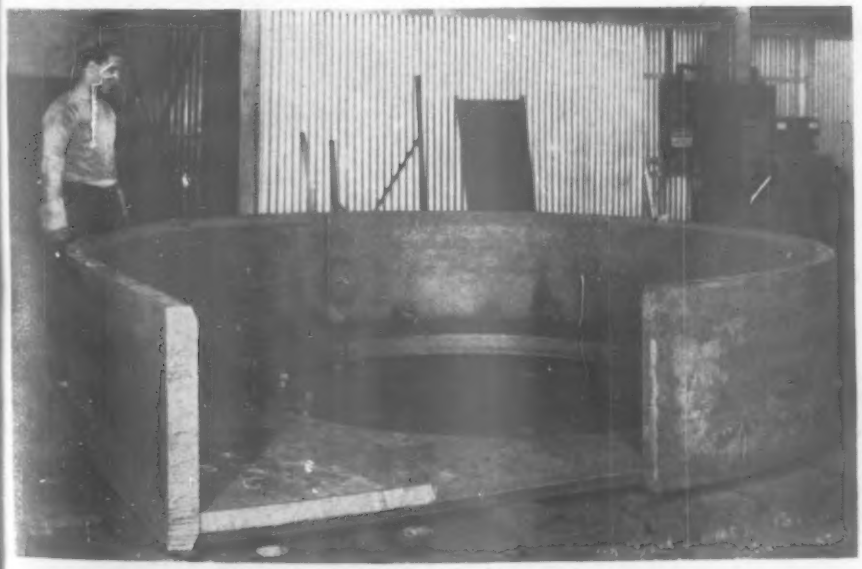


Fig. 10—Even heavy plate can sometimes be formed advantageously by bending rolls. These plates are 4 in. thick.

Subassembly Considerations

Subassemblies are frequently important to the designer of weldments. Obviously, the more work that can be done on small pieces, the easier and quicker will be the completion of the final assembly.

Subassemblies should be made so that particular portions, as required in certain instances, can be sized before they become part of the final weldment. (Where tolerances have accumulated, straightening or trimming may be involved.) This practice helps to insure that the final weldment is close to required dimensions and eliminates the effects of warpage or shrinkage on the subassembly as a factor in the finished weldment.

In very complicated structures involving considerable welding, subassemblies are sometimes stress relieved before being assembled into the whole structure in order to reduce the accumulation of residual stresses.

Subassemblies also facilitate weld inspection. X-ray inspection in particular is facilitated by subassembly welding, for at times the interference of adjacent components in the completed assembly may make it impossible to X-ray or repair certain welds. This condition is avoided by X-raying the subassemblies.

Subassemblies are often welded completely when they include compartments subjected to pressure tests or oil-retention specifications. The tests are made, and the necessary repairs completed on the subassembly piece. Clearly, this practice is more economical than to attempt such work

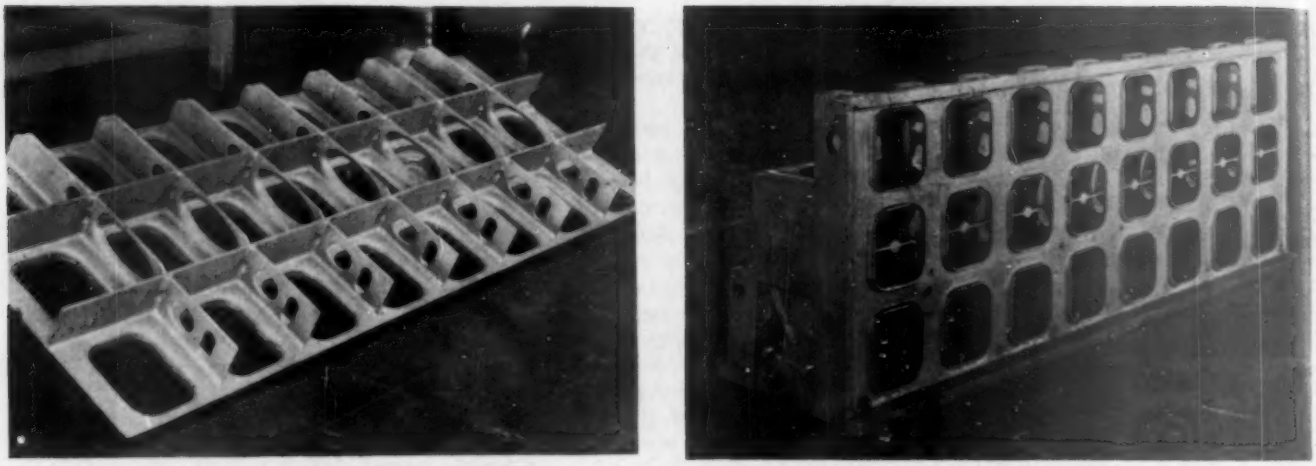


Fig. 11—This subassembly provides ready access to all welds, as may be seen from the completed weldment on the right.

on the final piece, if only from the standpoint of the relative bulk to be handled in testing and repairing.

Easier Access to Welding

An important reason for careful consideration of subassembly possibilities is the provision of maximum access to the greatest possible amount of the welding to be done. The more accessible the welding, the less it will cost, and quality is more readily achieved if the welding operator can work under open or accessible conditions. Fig. 11 shows a subassembly on which all welding to be done is before the operator. Obviously, the welding problem has been simplified since the joining welds between sub and main assemblies are completed by working through the access openings shown. If the welding had not been completed in the subassembly, it would have had to be performed through such openings. This would have necessitated the use of a mirror by the weldor, with resulting slow and consequently expensive welding.

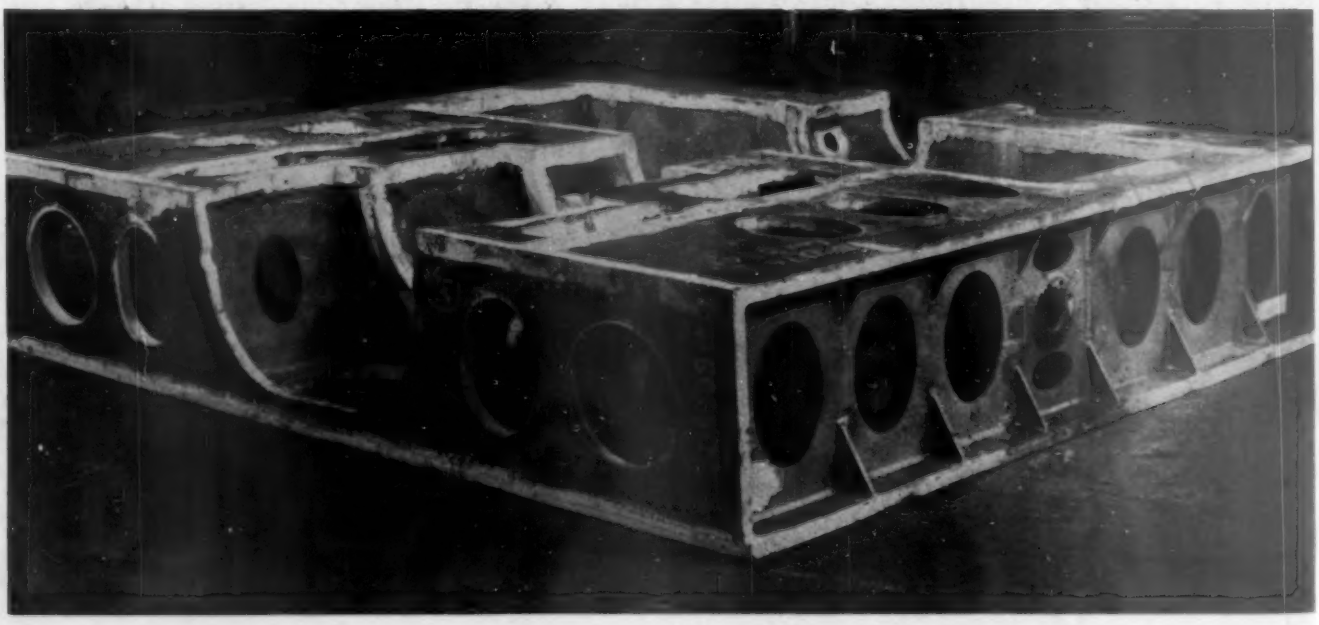
At times it is advantageous to design so that progressive subassembly is possible; *i.e.*, one portion of the weldment is completed before it is assembled and welded to other components as a step in the final assembly of the completed weldment.

When maximum access is provided, by subassembly practice or other design control, inspection can be more conclusive. Fig. 12 illustrates a design with elliptically shaped openings that permit access to the inner sides of the joints to be welded. Here care has been taken in shaping the openings so that abrupt discontinuities in the contour of the members are avoided, and the desirable structural qualities of a box member are not sacrificed.

Welded joints of maximum quality and predictability from the standpoint of either external contour or internal soundness are almost impossible to execute with the manual arc if the joint is not reasonably accessible from both sides. At certain points, however, where stresses are of secondary nature and fatigue loading is not present, the joints do not require work on both sides.

Part II, to be published next month, will discuss further important design considerations such as the position of joints in weldments, treatment of spoked or diagonal members, welded intersections subject to high stress levels, or to fatigue, impacts, etc., shrinkage and warpage problems, meeting specifications, inspection methods, weight control and rigidity.—The Editors.

Fig. 12—Lower section of welded gear-reduction housing. The elliptically shaped openings permit easy access to the inner sides of the joints to be welded.



1945—Year of Triumph

(Continued from page 37)

During the war years, welding was an important factor in keeping farm implements in repair. The farmer soon learned to rely on the local job-shop weldor in cases where the implement dealer could not furnish a replacement part. The job-shop weldor, confronted with the emergency, would either repair the broken part or fabricate a substitute; the welded part, whether repaired or fabricated, often proved superior to the original. As a result, the farmer has become wholly familiar with the uses of welding and hard-facing. Naturally, he wishes to continue to use these valuable processes.

Welders for the Farm

To cope with the definite trend toward increased welding on the farm, the National Electrical Manufacturers Association, in coöperation with the Rural Electrification Administration, Iowa State College and several Iowa utility companies, made an extensive study of the operation of arc welders on the farm. Both REA and utility managers, NEMA learned, were desirous of some standardization in the design and manufacture of arc welders for farm use.

An outgrowth of the study is a new NEMA standard for limited-input, transformer-type a-c welders designed especially to meet farm demands. The new standard, the first to be introduced for transformer-type welders below 200 amp, calls for two welders with maximum rated loads of 130 amp and 180 amp, which may be used on farms served by transformers of 3 kva and 5 kva respectively, the prevailing REA sizes. The new standard is developed to apply to weldors served by single-phase power lines of limited capacity supplying farms or small communities.

These welders are rated (see Table I) on the basis of maximum output at 20% duty cycle at a load voltage which gives satisfactory welding. (It is believed these welders will not be subjected to the severe duty encountered in industry.) A maximum input is assigned, which must not be exceeded in meeting the maximum output. The input is limited so that power companies serving the welders may know what to expect as maximum line load conditions.

Progress in Pressure Welding

Gas pressure welding, comparatively new a year ago, has expanded its uses into many industries. Industrial uses of this process are many and so are its users in the field. Practically every major railroad in the country is now joining some sections of its track into continuous rails by gas pressure welding. And pressure-welded pipe lines have gone up hill and down dale over practically every terrain and in every climate afforded by the United States—there are now thousands of miles of such pipe lines.

Turning our attention to hard-facing, we find that its new developments include a method for introducing powdered hard-facing material into the welding gases. This is done in a manner similar to that used in injecting powdered flux in flux flame-cutting. The application of hard-facing material in finely divided solid form eliminates the need of both rods and fluxes. The process should make it easier to deposit a hard overlay without distortion — and overcome many difficulties previously experienced because of distortional conditions.

Table I. Limited-Input Type, Transformer Arc Welders

(Tabulated Characteristics Extracted from Nema Standards)

There shall be two ratings—130 amperes and 180 amperes.		
1. Rated load amperes (maximum obtainable at rated load voltage)	130	180
2. Rated load voltage	25 volts	25 volts
3. Minimum welding current	20 amp	20 amp
4. Duty cycle at rated amperage	20%	20%
5. Maximum open circuit (no-load voltage) at any current setting	65	65
6. Primary volts	230	230
7. Amperes input at rated load when built without power factor correction shall not exceed	33	46
8. Amperes input at rated load when built with power factor correction shall not exceed	27	37
9. Short-circuit current—maximum allowable ratio of short-circuit current to rated current at rated load volts	150%	150%
10. The input current at any reduced output current setting shall not exceed the rated input current.		
11. The no-load input current of a power-factor-corrected welder shall not exceed 50% of its rated input current.		

NOTE I—The same methods of test and temperature rise provided in NEMA Standards for industrial-type welders apply.

NOTE II—These welders shall be supplied with primary connection accessories consisting of not less than 6 feet of three-conductor primary cable, one conductor of which will serve to ground the case, cores or other non-current carrying parts, and a three-prong polarized plug and matching receptacle.

Resistance Welding Expands

While few spectacular new developments occurred during the year in resistance welding, an astounding expansion was revealed in the uses of these processes. The close of the year found many users of wartime resistance-welding equipment plotting ways and means to convert it to peacetime production. Without doubt, many spot-welded, flash-welded and seam-welded products will soon appear to replace their prewar ancestors assembled by other means.

The sudden advent of peace has so far had no material effect on the demand for new welding equipment. Labor unrest and other disturbed conditions have undoubtedly been reflected in some localities. In general, however, the demand for welding equipment and supplies has exceeded the expectation.

Electrode sales, of course, have been off because of inventory adjustment. This was expected and will soon be corrected when peacetime production gets underway. For welding in general, the outlook for the future is good, barring continued strikes.

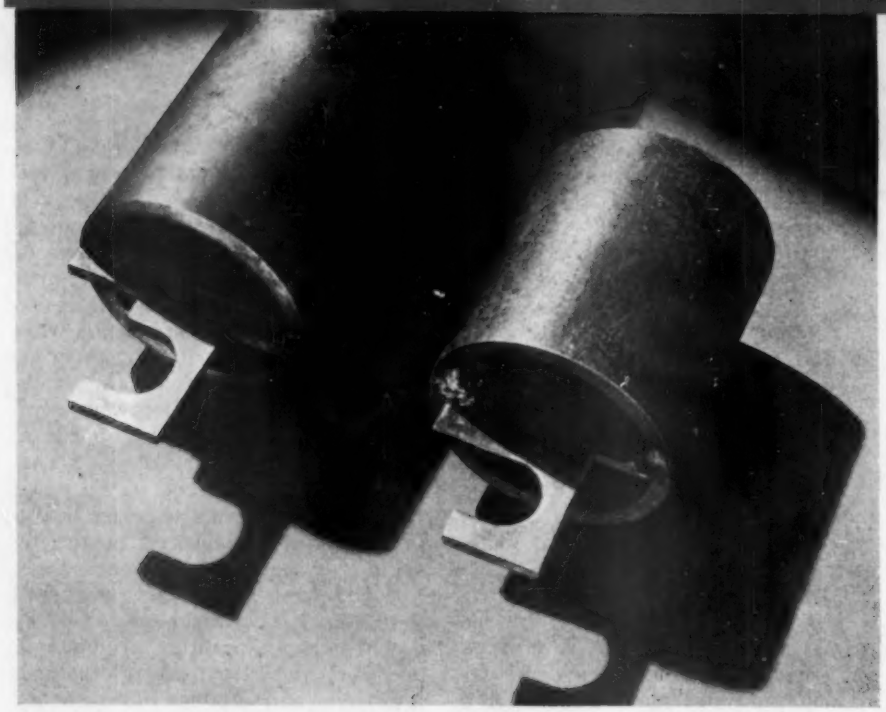
Just as welding, flame-cutting and flame-treating processes contributed to our wartime victories, they will now contribute to our peacetime living. They will make for more satisfactory products — products better suited to render the services for which they are designed.

Method Found to Join Gold and Palladium

A new method of combining gold and palladium in diagonal, vertical or horizontal stripes is announced by the D. E. Makepeace Co., Attleboro, Mass. The resulting product, called "Palladium Stripe," is being offered to jewelry manufacturers in either solid metals (14-carat gold and white palladium) or with the two precious metals superimposed on a base metal like rolled gold or gold plate.

Postwar Resistance Welding

By J. W. KEHOE and I. A. CRAWFORD
Headquarters Manufacturing Engineering Dept.,
Westinghouse Electric Corp., East Pittsburgh



Resistor hook tube support or mounting hook. Spot welding effected savings of approximately 40%.

RESISTANCE welding was utilized in the prewar period primarily as a tool to reduce costs of assemblies. It was not intended to displace other welding methods. The utilization of resistance welding accelerated production during the prewar period, and it was immediately put to use on a large scale with the beginning of wartime production.

During the war period, it was found that qualified resistance-welding operators could be quickly trained and placed on production. Electronic timers came into widespread use, removing much of the difficulty formerly prevalent in securing welds of uniform quality. By minimizing the importance of the "human factor," electronically controlled resistance welding enabled industry to utilize less skilled manpower for difficult welding operations.

Planning for Postwar Uses

Proved as a successful method of joining metals prior to the war, resistance welding occupied during the emergency a prominent position in the metal-working industries. In the present postwar period industry will continue to utilize this method of joining metals and will carry on further research and development work. Recognizing the quality and cost advantages of this process, the Westinghouse Electric Corp. has made a concerted effort to promote its use throughout the company. Division managers were consulted as to the possibilities of resistance welding within their respective divisions. Reports covering the hours involved and proposed projects were submitted and closely analyzed. It was immediately realized that the potential cost reductions were tremendous. However, a definite program covering resistance-welding applications had to be set up.

Department Responsibility

The utilization of resistance welding has been placed in charge of the Headquarters Manufacturing Engineering Department. Helping to insure adequate support of the resistance-welding activity are the various sections of the department:

I. Manufacturing Research
II. Manufacturing Methods Applications
III. Materials Joining—arc welding, resistance welding, brazing, soldering, etc.
IV. Manufacturing Cost Analysis
V. Plant Layout and Material Handling
VI. Auxiliary Equipment Application—tool and fixture design

From Laboratory to Shop

Welding problems are referred to the Materials Joining Section, which has at its disposal in its welding laboratory up-to-date types of press, gun, seam and bench welders equipped with the latest electronic timing controls. Development work done on the laboratory equipment is duplicated in the shop equipment. This is sometimes accomplished by actually doing production work on the laboratory equipment until such time as the shop and supervisory personnel are familiar with the technique and procedures involved. When this is accomplished, the production work is transferred to the shop. This arrangement has permitted more difficult jobs to be worked out outside of the welding production sections and has enabled the development of restricted wartime jobs under the surveillance of competent welding engineers.

The personnel of the Materials Joining Section can be compared to a group of consulting welding engineers. Engineering and production heads are in constant touch with this personnel and aim to discuss designs prior to the final drawings. Full-scale models are sometimes built prior to final engineering approval, thereby giving the engineering and production heads an opportunity to discuss the problems involved.

Considerations Prior to Design

Another advantage of this proce-

It is generally conceded that more rather than less resistance welding will be used for the manufacture of postwar civilian goods. Westinghouse is planning for a large-scale conversion to resistance welding.

dure is that it educates the design engineer to think in terms of resistance welding. The greatest economies and manufacturing improvements in a new product are obtained when the product is designed specifically for resistance welding. Before any recommendations for resistance-welding design are made to the design engineer, however, the following nine considerations should be analyzed:

1. Application and requirements.
2. Activity involved.
3. Materials to be used.
4. Type of joint required.
5. Types of resistance-welding processes.
6. Size of parts.
7. Welding equipment and power requirements.
8. Tools and fixtures.
9. Welding information.

Application and Activity

In designing a product for resistance welding, the type of application is very important. Operating requirements such as shear, tension, compression, impact and torque loads, vibration, intermittent or constant load, should be fully recognized. These factors not only determine the quality of the product (or welded joint) but cost as well. Whenever possible, the design should eliminate unnecessary welding, keeping in mind quality, cost and sometimes appearance.

A consideration of the activity involved is also important and must justify the cost of the required tooling, fixtures, and equipment. Often it is possible to group items of small activity to justify recommendations for resistance-welding design.

Materials and Preparation

The selection of proper material is very important in designing for resistance welding. Certain shapes such as round, formed or structural can be used with little or no machining preparation. It is often possible to put projections on screw machine items with little or no additional cost. The nature of the material—steel, aluminum, copper, brass alloys, etc.—will affect the weldability of the design. The surface condition of the material—whether it is pickled, oily or scaly—must be considered, and where necessary the surface must be properly prepared. Where aluminum or copper alloys are to be used, it is generally necessary to provide special cleaning facilities. At Westinghouse, questions concerning the weldability of various kinds of materials have prompted the issuance of relevant information in the form of a works standard sheet.

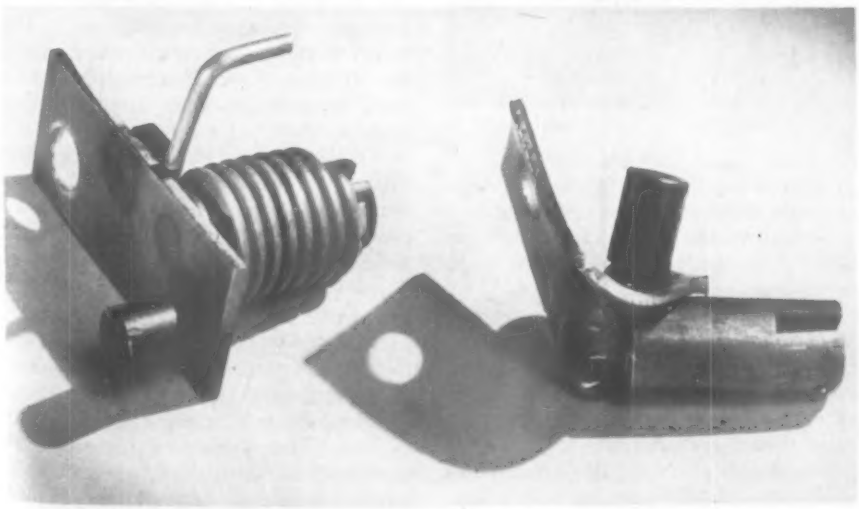
Spot welding blower vanes to sheet steel rings. The fixture is designed to index at the correct spacing.

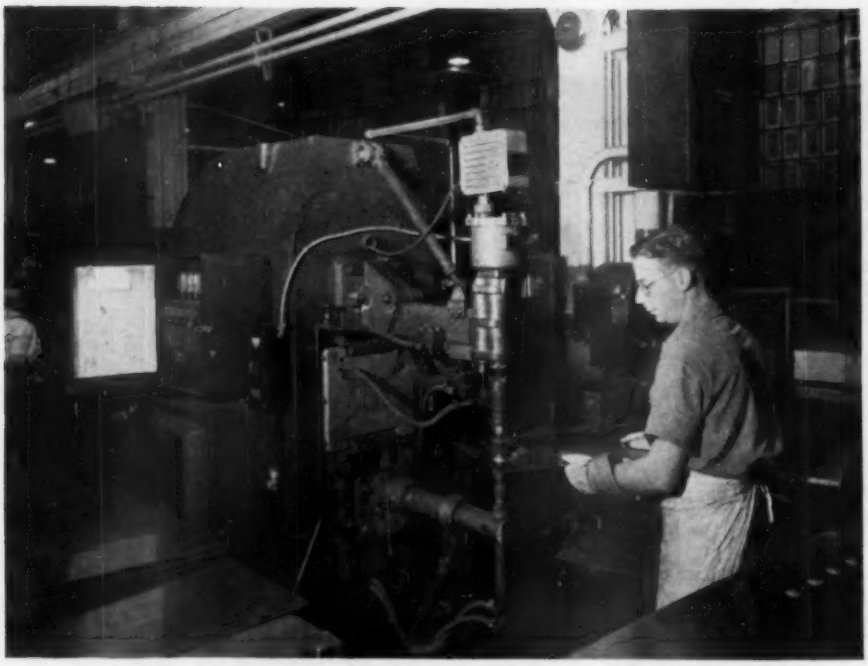
The type of joint required is a determining factor in the weldability of the product and must be considered by the engineers who design for resistance welding. Factors such as flange width, size, location of spot or projection welds are also important. It is not always possible to use the best type of joint, in which case it is necessary to use an alternative design based on cost comparisons of various design possibilities.

Choosing the R-W Process

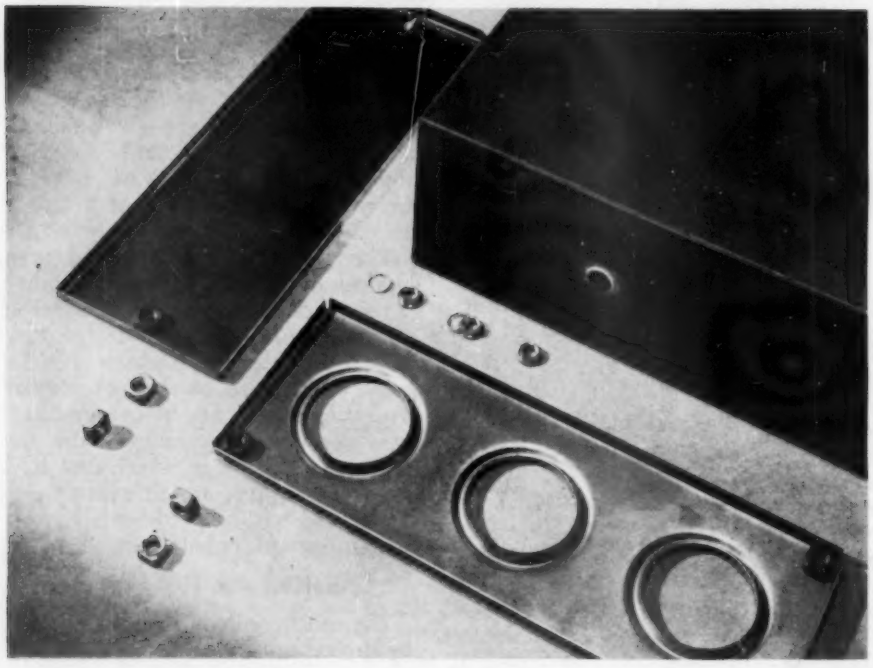
The most common resistance-welding processes are: spot, projection, seam, gun, butt and flash welding. Spot and projection welding are usually done on a standard press-type resistance welder. There is an adaptation for spot welding, known as roller spot welding, which, together with seam welding, is done on a resistance seam welder. Gun welding (portable spot welding) has application when it has been proved more economical to move the welding machine to the work than to move the work to a stationary machine. Flash and butt welding are done with resistance flash- and butt-welding equipment. The cor-

Small projection-welded door interlock. It includes two pins and boss spot welded to 1/8-in. steel strip. Projection welding saved 35% of the cost of the plug welding formerly used and avoided distortion. Test specimen at right shows that it is nearly impossible to break a properly made projection weld.





Resistance brazing of capacitor bushings. The steel bushing is brazed to a steel sheet before the sheet is formed into a can. Silver-solder flux and a silver-solder ring are then used to join the bushing to the can.



rect appraisal of the previous considerations, Items 1 to 4, should determine the particular welding process to be recommended.

Small and Large Parts

The size of the parts to be welded must be considered on an economic as well as on a practical basis. In the case of very small parts—those used in electronic tubes, for instance—proper color contrast, lighting, perhaps the requirement of gloves to prevent oxidation, the use of tweezers or some small holding device, the type of welding machine and controls are among the factors which have to be considered.

Where large parts are to be resistance welded, the application of the correct type of handling methods will simplify operations and make possible jobs which ordinarily would have been considered impracticable because of their size. Ball-top tables with vertical adjustments fitted right into the resistance-welding machine have solved many difficult handling operations where the joint is in one horizontal plane.

The use of a gun welder may be the solution when the parts cannot be transported to the welder, either because of their size or because of the large welding jigs or fixtures required. Jib cranes, fixed or portable, have been found useful where large parts are handled to the machine. Here, again, proper engineering design aids in the application of resistance welding to products hitherto considered too big or too heavy to handle by this process.

In considering recommendations for engineering design for resistance welding, it is necessary to keep in mind the handling facilities which are available in the sections where the welding production will be done. It is sometimes possible to make the necessary arrangements to have the welding production done in the various manufacturing sections which have proper handling and welding equipment. Or perhaps proper handling equipment can be provided and paid for by the cost reductions obtained by resistance welding.

Equipment and Power

Where large parts are to be resistance welded, the use of deep-throat welding machines may be required. The modern, thoroughly advanced system of applying welding pressure and the incorporation of positive electrode cooling systems, along with the strong mechanical constructions being used by resistance-welding machine manufacturers, have minimized some of the limitations of deep-throat machines. Resistance-welding controls have also aided in increasing machine capacities.

Where deep-throat machines are not required (as on some heavy projection-welding applications) but heavy welding pressures are necessary, the shortest throat machine should be used in order to keep down the kva requirements. Equipment and control manufacturers are now endeavoring to reduce resistance-welding kva demands by other methods in order to permit the extensive use of resistance welding throughout all industries.

At Westinghouse, the correct type and size of welding machine and the proper control for a particular application is determined by the welding development section and passed along to the manufacturing division involved. The works engineering department is consulted on available power facilities, and proper provi-

RESISTANCE-WELDING JOB RECORD

Date_____

Drawing #_____ Name of Part_____ Assembly of Items_____

Material - Top_____ Spec. #_____ Thickness_____ Bottom_____ Spec. #_____ Thickness_____

Surface Condition_____ Pickled_____ Shotblast_____ Bright Dipped_____ Method Cleaned By_____

Spotweld_____ Seamweld_____ Braze_____

Developed in Dept._____ On Machine #_____ KVA_____

To be Processed in Dept._____ On Machine #_____ KVA_____

Machine Settings	Time Required
Tap Setting_____	Top_____ Matl._____ Size_____
Pressure_____	Stretch_____
Current Reading_____	
Throat Depth_____	
Throat Opening_____	
Squeeze Time_____	
Heat Percent #1_____	Bottom_____ Matl._____ Size_____
Hold Time_____	Sketch_____
Pulsation - Times_____	
Heat Percent #2_____	
Cool Time_____	
Weld Interval_____	
Forge Time_____ Preheat Time_____	
Remarks_____	
Pull Test_____	Developed By:_____
Hammer Test_____	Production Operators_____
Weld Appearance_____	
Diameter of Slug or Button_____	Accepted By:_____ Date_____
Diameter of Heat Zone_____	
Percent of Material in Throat Welder_____	

Job-record card used at Westinghouse. The card gives complete information, is submitted to the resistance-welding supervisor when the developed product has been accepted.

sions for adequate power supply are made. The recommendations must be justified either by the particular job for which equipment and power are required or by future planning.

When recommendations are made to change from another type of fabrication to resistance welding on available equipment, a thorough study is made to insure that the equipment used is of sufficient capacity to produce the required quality of welding. When it is seen that the power lines are questionable, this fact is brought to the division's attention so that they can make the necessary corrections. A separate source of power for resistance-welding controls is always recommended.

Tools and Fixtures

Correct manufacturing tooling has enabled the design engineer to give more consideration to designing for resistance welding. The application of the proper types of punching and forming tools, dies and methods has made it possible to adopt standard tools and thus utilize standardized methods of manufacture.

Welding jigs or fixtures should be so designed that they will not permit improper parts or improperly aligned parts to be used, and they should be insulated in such a manner as to concentrate the welding current at the joint and thus prevent any bypassing of current. The fixture should not heat up nor change its shape, a requirement which involves proper consideration of materials as well as fixture design.

It is possible to design the fixture so that it can be connected to one or both arms of the welding machine, and the parts located and removed by quick-acting levers, cams or clamps. Some engineering designs for resistance welding provide for the mounting of welding fixtures on the parts to be welded, as on flanges or corners. In some cases the type of handling equipment will dictate the type of fixture design. It is sometimes possible to eliminate costly fixtures requiring tool shop manufacture by substituting simple gadget-type fixtures which can be made in the production section. Accuracy requirements and activity are the governing factors in this respect. A close and periodic check-up on the condition and usability of welding fixtures is very important and has proved very economical.

Recording Information

The issuance of welding information in the Westinghouse organization is the direct responsibility of the development section, where the design and tooling methods are tried and proved to be economical and adequate. A job-record card giving complete welding information is submitted to the resistance-welding supervisor when the developed product has been accepted by the proper people among the engineering and production heads. A sample job-record card is reproduced above.

Some applications may justify a process specification, in which every detail connected with the job is thoroughly covered and observed by those responsible for quality control. The process specification specifies the type of welding equipment and control and recommends the proper type of cleaning or surface preparation. The record on a particular item covers all current, pressure and time settings, throat openings and depths, electrode shapes, sizes and type of alloy used, etc. A duplicate record is made, one copy being sent to the welding supervisor and one copy kept on file in the welding section.

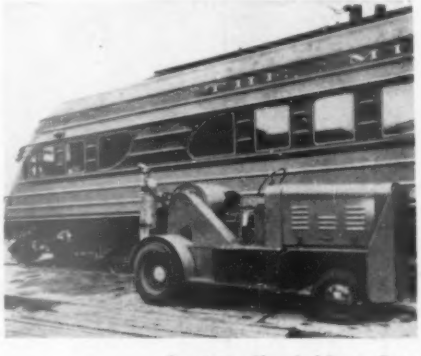
The type of organizational personnel that is best suited to carry out the resistance-welding production of the developed designs is beyond the scope of this article. It is important that thoroughly capable and competent supervision be given to the welding details involved. Maintenance of records and recommendations (as well as equipment) is very essential to quality production at lowest cost.

The best type of equipment, controls, tooling, fixtures, the most complete welding information are not in themselves enough if the product's design has not been developed and proved for resistance welding.

Mobile Welding

ABLE to maneuver close to the work, the new "Shop Mule," carries arc-welding and oxy-acetylene equipment to jobs in the field. This self-contained welding unit is manufactured by W. F. Hebard & Co., Chicago, for railroad and industrial use.

An arc-welding generator with a range of from 30 to 375 amp is mounted under the roll hood behind the driver's seat. At the rear are racks to hold one oxygen and one acetylene cylinder.



Courtesy, Harnischfeger Corp.

This compact equipment makes field welding almost as simple as shop welding.

That Versatile Stud Welder

Developed primarily in order to speed shipbuilding, the electric arc stud-welding process has a host of uses and is applicable to any industry where metal studs or pins must be end-welded to metal surfaces.

By CLYDE B. CLASON

Fig. 1—Stud-welding outfit including gun and control cabinet. The spacer legs on the gun hold the alignment while the stud is driven exactly at the center marks.

NOW available for peacetime industry is the stud-welding gun — a development prominent among those which helped make it possible to build a welded Liberty ship in an all-yard average of 51 days and to produce over 3,500 welded ships to supply our allies and armed forces. The stud weldor's "rocket gun" may be used to end-weld steel studs of many different types and employed for a multitude of purposes. By means of this versatile process, wood may be secured to steel, or insulation materials of many kinds can be fastened firmly with large-headed welded pins or other special studs.

Peacetime Applications

One of the greatest peacetime opportunities for stud welding probably lies in the electrical field. In steel-constructed buildings, stud-welded electrical installations of all kinds will save time and materials. All types of wire and conduit, switchboxes, panels, outlet boxes, etc. can be quickly installed on steel walls by means of welded studs. The use of studs to secure straps or hangers will eliminate the costly, time-consuming operations of drilling and tapping bolt holes. Metal supports for switchboxes can be secured by studs as can pipe hangers and fire-extinguisher systems.

Other peacetime uses are legion. A few specific examples, scattered at random over various industries, are: securing plastic materials over plywood, installation of linings for gasoline storage tanks, construction and maintenance of railroad cars and locomotives, construction of dehydrators, studding boiler tubes, boiler maintenance and manufacture, construction of water tanks, electrical panel assembly, securing electrical insulators, manufacture of transformers and other heavy electrical equipment, studding open-hearth furnace doors for refractory material, studding rollers on cotton pickers, insulating pulp dryers, reinforcing sprayed-on cement, lagging oil refinery heat exchangers, holding down bubble tower caps, securing manhole and other bolted covers, securing screw-type parts to steel castings, securing galvanized sheet-metal roofing . . . this list is by no means exhaustive nor is it meant to be.

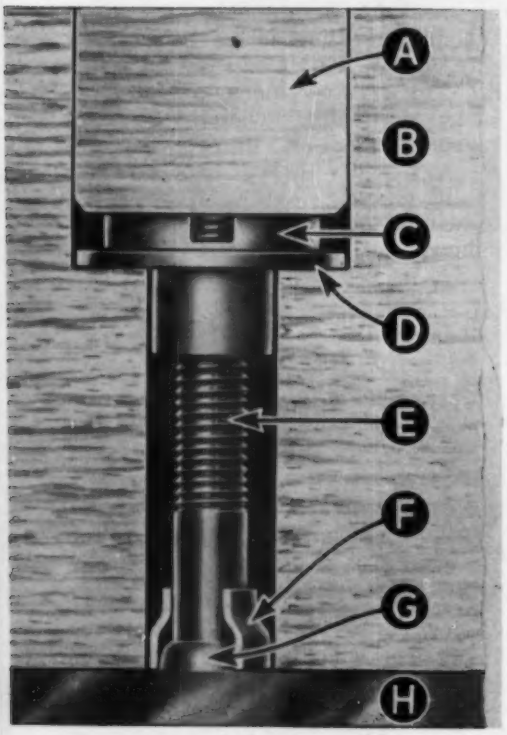


Fig. 3—Method of securing wood decking (B) to a steel subdeck (H). The other letters indicate the wood plug (A), slotted nut (C), washer (D), stud (E), porcelain ferrule (F) and weld fillet (G).

Stud, Gun, Control Cabinet

The stud, ordinarily a machined screw with a flux-filled tip, is end-welded at the particular spot desired by means of a compact portable equipment developed by the Nelson Specialty Welding Equipment Corp. of San Leandro, Calif. This consists of a welding gun and a cabinet which houses a welding contactor, relays and electro-pneumatic timer. Welding current is drawn from a 400 amp d-c generator, using straight polarity. Both gun and timer cabinet are shown in Fig. 1. The gun weighs approximately 5 lb; the cabinet around 50 lb. Guns are available in several types with one, two or three spacer legs.

The gun is loaded by inserting one of the flux-filled studs into a chuck, which is an integral part of the gun. A porcelain ferrule surrounds each stud to shield and protect the arc. The operator places the gun in the proper welding position so that the end of the stud and the spacer legs will be pressed firmly against the metal plate. A small amount of preweld current will flow through the stud to assist in making a good contact with the plate by burning through paint or rust. The operator depresses the trigger . . . the control box comes into action, and the job is finished in less than a half second.

Automatic Arc-Timing

Once the trigger has been pressed,

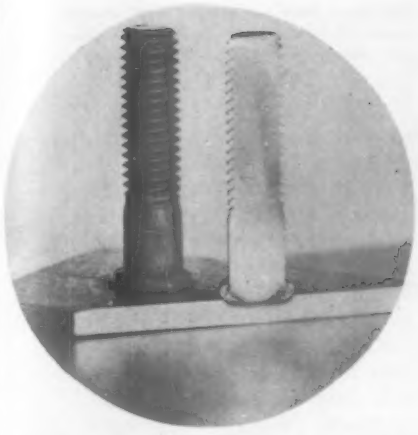


Fig. 2—Cutaway view of stud weld. This sample was etched with Nital to bring out the weld area. Note the complete fusion of the weld metal to the base plate. If desired, the size of the fillet can be reduced through the use of special reduced-base studs.

the entire welding cycle is automatic. The flow of the 400 amp welding current activates a solenoid coil, which lifts the stud a short distance above the plate to create an arc. This is held for the proper length of time as regulated by the timer, and then the force of a 20 lb spring drives the stud into the pool of molten metal. That is about all there is to stud welding, which is an extremely simple process.

To get quality welds, the operator merely has to learn the not-too-difficult art of setting the gun and generator correctly for each size and type of stud. Care and judgment must be exercised as in all welding processes to adjust the generator and control box to the proper settings to obtain consistent results. The duration of the weld is controlled by the electropneumatic timer in the control box; this is calibrated in cycles—fractions of a second. When the preset time has elapsed, the timer disconnects the welding current, and the main spring in the gun shoots the stud into the molten metal to complete the weld. Once the timer has been set for a certain size and type of stud, it will repeat the welding cycle indefinitely without further attention on the part of the operator.

Speed and Quality

Once welded, the stud becomes an integral part of the plate, as chippers who have been given the job of removing them can testify. The "cut-in-half" stud of Fig. 2 shows the complete fusion resulting from the combination of accurate arc timing, flux-filled stud and porcelain ferrule to shield the arc from the atmosphere.

The weld shown in Fig. 2 was obtained in less than ½ second. Newly trained operators can make 500 to 1,000 welds a day, it was conclusively demonstrated in shipbuilding. If these "rocket guns" had never been invented, arc weldors would have had to do most of the stud jobs required on board ships by welding pads and bolts to bulkheads. About 80 to 100 pads can be painstakingly welded in eight hours—the same period in which as many as 1,000 studs can be welded.

Since virtually every phase of stud welding is automatic, no previous welding experience is necessary to learn to operate the gun. Inexperienced operators are quickly trained for this work. The light weight and pistol-grip handle of the gun render it a relatively easy tool to handle, even in difficult locations. Other important advantages are the portability of the equipment and the extreme versatility of the stud-welding process. The studs are available in a wide range of diameters and lengths and in many different shapes and forms to meet special requirements.

Uses on Ships

Since the stud-welding process was originated primarily to facilitate shipbuilding, it might be well to look at some of its principal contributions to that industry. Each Liberty ship requires some 50,000 to 75,000 studs; each C-4 vessel approximately 300,000. This young army of studs is used to secure wood decking, furniture tread-plates and all types of insulating material; to mount manhole covers; to fasten hangers for pipe and conduit; to secure electric light fixtures and switchboxes, and so on down a long, long list.

Some of these marine applications are shown in the pictures. Fig. 3, for instance, shows the manner in which wood flooring is secured to steel subdecks. The wood plank (B) is drilled at the desired center, counterbored to the desired depth and laid over the subdeck (H). The next step is to clean the steel of all paint, rust and galvanizing by working through the hole in the planking. A porcelain ferrule (F) is inserted, and the stud (E) is welded through the hole. A lampwick grommet and a cadmium-plated washer (D) are then placed on the nut, and the slotted nut (C) is tightened to secure the plank. Finally, a wood plug (A) is driven into the counterbored hole and planed down flush with the deck.

The securing of pipehangers, conduit and wireways with studs saved thousands of man-hours in ship construction. Some of the common methods of application are shown by the arrows in the accompanying sketches (Fig. 4). Insulated wire and cable alone account for about 10,000 studs on a Liberty ship, 55,000 on a C-4. Every 12 or 14 in. a metal strap

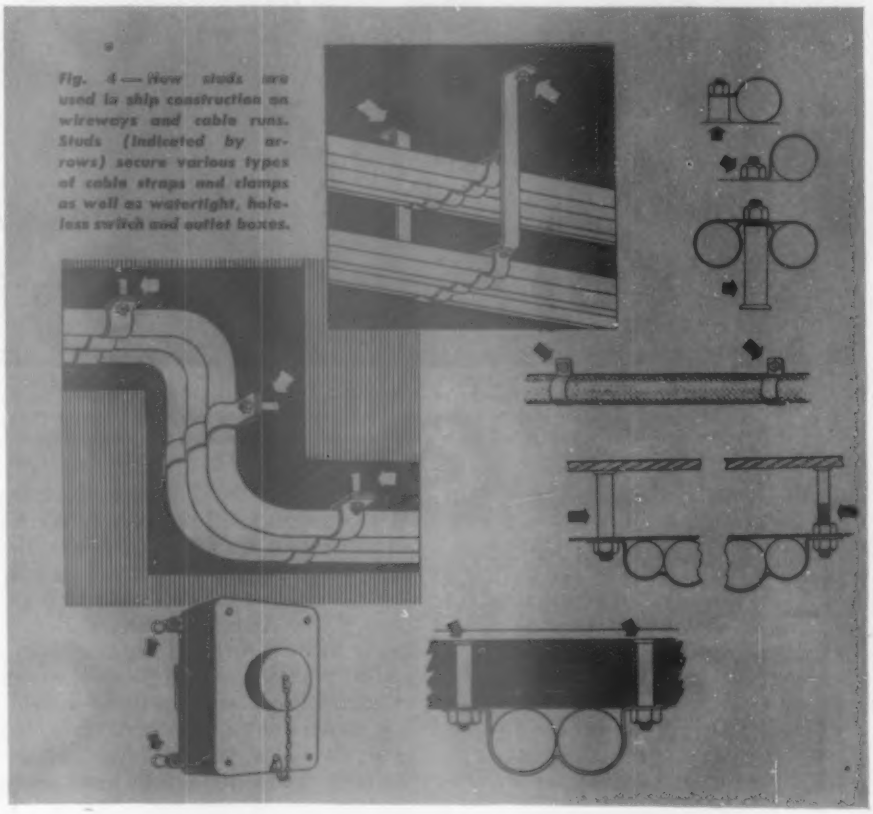


Fig. 4—How studs are used in ship construction on wireways and cable runs. Studs (indicated by arrows) secure various types of cable straps and clamps as well as watertight, hole-less switch and outlet boxes.

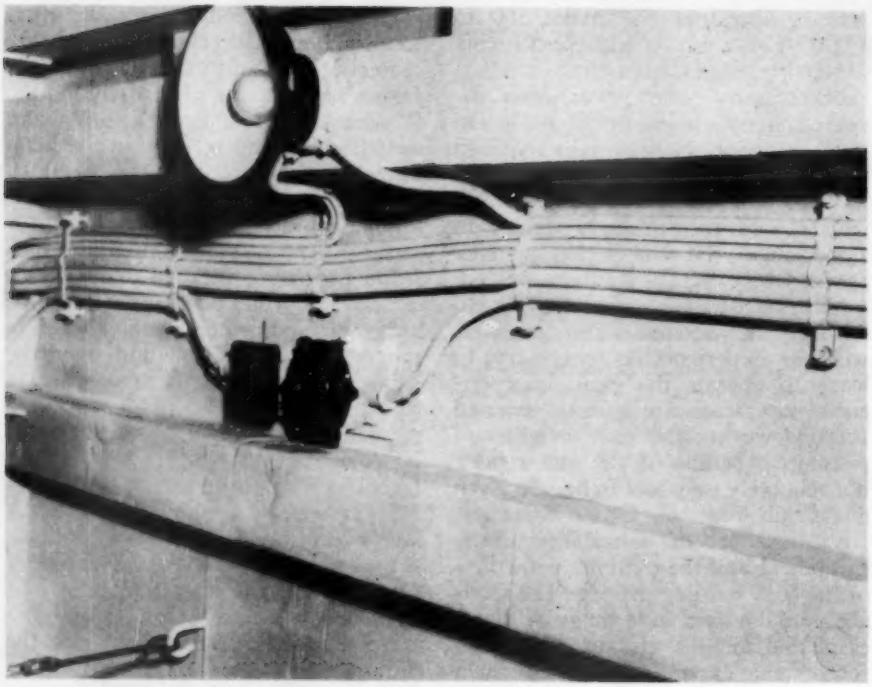


Fig. 5—A cable run secured with shoulder studs. Faintly visible through the paint are the round heads of the pins used to hold the insulation in place.

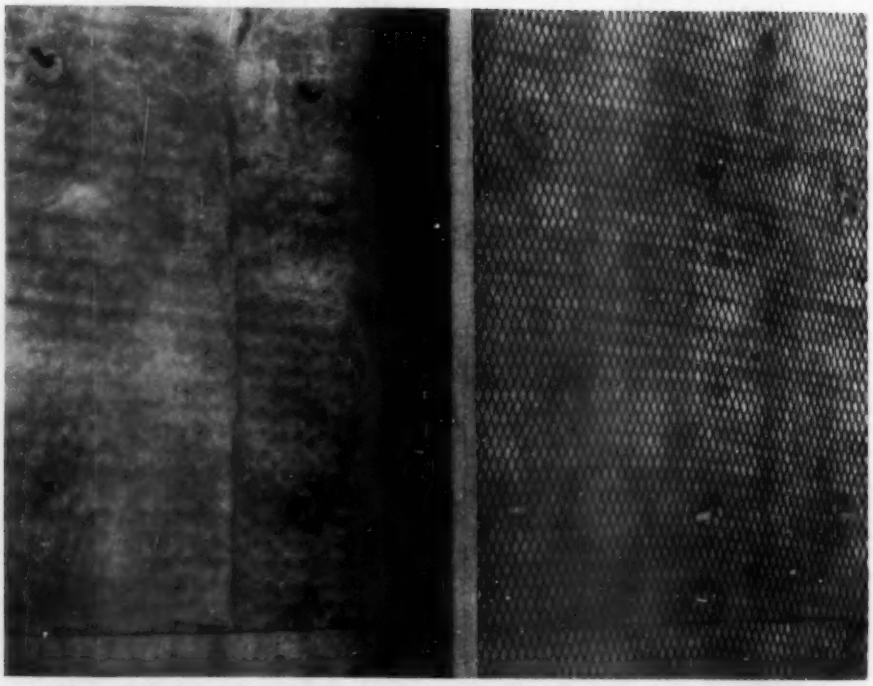


Fig. 6—Close-up of studs and washers for securing metal lath. On the right the insulation, stud and washer are in position; on the left the lath has been added and secured by bending the stud heads.

bolted to studs must be inserted to hold the cable run, as shown in Fig. 5.

Holding Insulation in Place

Fig. 5 also shows another important application of the stud-welding gun—the securing of fibre-glass insulating material on overhead and sidewall construction. The disc-like heads of the insulation pins show up rather faintly under the paint coating.

The pins used for securing insulation material vary in length from ¾ to 6 in. and will thus accommodate virtually any thickness of insulation. The welds are made with the insulation material in place against the bulkhead. The slender-diameter pin is easily pushed through the insulation, and its pointed end will pierce through paint, rust and scale to make a welding contact with the steel plate. In general, these pins are of smaller diameter than the studs and so a shorter arc time is required (approximately 0.1 second).

A different means of securing soft-glass insulation that must be covered with plaster is revealed by Fig. 6. Here the insulation is covered by metal lath to provide a bond with the plaster, and the pin is required to do a double job: hold the insulation as before and also secure the metal grillwork. For this purpose, special metal-lath studs are used. They are welded to the bulkhead in the usual manner, after which the insulation is impaled on them. Self-locking washers are then affixed to prevent the lath from compressing into the insulation. This stage is shown on the right of Fig. 6. The lath is then installed, and the heads of studs are bent to lie flat against the lath as shown on the left side of the picture. When the plaster is laid, it will produce a smooth, durable surface.

Prefabricated Covers

Stud welding is also useful for prefabrication, as may be seen from Fig. 7. The lady in the picture is welding studs on manhole cover rings for landing barges. Each ring required 16 studs, and all 16 welds were made in 90 seconds. Another 35 seconds were needed to change the ring on the fixture, bringing the total welding time on each ring to 2 minutes 5 seconds.

Aboard ship or on land, studs may be used to do almost anything. Fig. 8 shows how they were used to hold the track of a flame-cutting machine so it could trim plates as they were being assembled to the ship hull. The studs were simply welded to the hull, and the track was bolted to them. After the plate had been trimmed, the line of studs was chipped off. This could be done satisfactorily because little undercutting results from stud welds and hence little fill-in work was necessary.

Stud Styles and Sizes

All-position welding studs of the type shown in Fig. 2, straight or with shoulders, can be obtained in diameters of ⅛, 3/16, ¼, ⅜, 7/16, ½, ⅝ and ¾ in. and in lengths jumping in ¼ in. steps from ¼ to 8¼ in. Longer studs are available on special order, and stainless-steel studs are also available in standard sizes up to and including ½ in. diameter.

Let's look at some of the special-purpose types. Insulation pins have already been mentioned. These are

Fig. 7—The stud-welding gun is readily adaptable to production fixtures as this picture proves. Sixteen studs were welded to the manhole cover ring in 90 seconds.

made with either cupped or flat circular heads. To further secure the insulation, a self-locking "speed clip" may be forced over the head after the pin has been welded.

Drive screw studs are used to secure cement-asbestos board and insulation. Each of these units consists of a hollow female stud and a drive screw with a flat head of 1 in. diameter. Holes at the desired centers are drilled in the cement-asbestos material for the hollow studs, which are welded in the usual manner. The ferrules are left in the holes, and a drive screw is hammered into each stud.

Sheet metal or other hard-surfaced material can be secured over insulation in much the same manner, using a slightly smaller drive screw with a ½ in. head. Female studs 5/16 in. in diameter are welded to the desired centers, the insulation is impaled and the sheet metal placed on top. The studs are located by tapping the metal with a hammer. A punch is then driven through the sheet into the stud to permit the drive screws to be driven into each female stud.

The use of metal-lath studs has already been described. These studs have flat heads which are easily bent over to secure the lath. There is also a rectangular metal-lath stud having a notch into which the wire of the lath is hooked. The top of the stud is then knocked over and permanently secures the wire. This type of stud is used for lagging, for reinforcing sprayed-on cement, for plastic decking, etc.

Bent Studs to Hold Things

Studs do not always have to be straight. Sometimes they are bent into odd shapes. Such studs are very useful for holding heavy objects or wherever there is need for steps on a metal frame. This type includes cargo batten studs, which are furnished either straight or with a right-angle bend, in lengths of 5½ to 6½ in. and diameters of 7/16, ½ and ⅝ in. A special chuck is used on the welding gun to hold the bent stud while the weld is being made.

When it is necessary to weld studs of shorter lengths than 1 in., a special circumferentially grooved stud is available in most diameters and threaded as desired. This type of stud is made only to special order as the grooved break-off point must be accurately determined for each particular job. After the stud has been end-welded in the usual manner, its top is knocked off at the groove, leaving only the short threaded portion.

Unthreaded grooved studs are also used for plug-welding applications in which two lapped steel plates are to be fastened together. A hole is punched or drilled (if plate thickness is greater than 18 gauge) in the top plate to permit the grooved stud to be end-welded to the bottom plate, fusing the two together. The stud is then broken off at the groove, and the raised portion of the weld is ground off if that is deemed desirable.

Hooks and Eyebolts

It is also possible to obtain studs with either hooks or eyebolts. Since these studs are manufactured on special order only, almost any shape or type is available. They can be end-welded to metal quickly and will save many hours of drilling, tapping and hand welding. Special chucks and an adjustable-leg unit must be used with the gun in order to weld these specialties.

A lagging stud has a round or slotted hole—and many applications where material is to be secured by wire or with a key through the slot. This type of stud is manufactured in ⅜ in. diameter with a minimum length of 1¼ in. The slotted hole is 5/32 in. wide by ½ in. long and may be located as close as ¼ in. from the unloaded end of the stud. Among the many uses for lagging studs are: securing storm curtains on Diesel locomotives, lagging ship uptakes, securing insulation in boiler fireboxes, securing magnesia blocks for insulation purposes in petroleum refinery storage bins, heat exchangers, catalyst bins, etc.

Reduced-base studs remain to be mentioned. These units have their bases machined to smaller diameters in order to reduce the size of the fillet at the base. This allows smaller holes to be drilled in covers and other parts, or it will avoid the use of countersinking when two plates are to be fitted tightly together. The minimum-diameter weld fillet also allows a gasket to be fitted closely to the stud.

Reduced-base studs are manufactured in two types: full and half reduction. Full-reduction studs reduce the weld fillet to 1/5th its normal size, and the half-reduction studs reduce it by about ½. A standard chuck is used in the gun with a special ferrule.

The applications which have been mentioned in this article merely serve to suggest the extreme versatility of the stud-welding process and its ready adaptability to construction and maintenance work. The list of uses is already long, and it may be expected to grow steadily from year to year as new applications of the end-welded stud or pin are discovered.

Fig. 8—A line of welded studs secures the track of a flame-cutting machine used to trim plates in hull assembly. The studs will be chipped off after the plate has been trimmed and welded.

★ RESEARCH

Electronic Tracing

Electronically controlled flame-cutting is flexible, accurate and economical. Ease of template preparation (the template is simply a drawing) opens up a way to cut complex shapes which formerly couldn't be handled.

By **WALTER BERGEROW**

In Charge of Mechanical Apparatus Section, Air Reduction Sales Co., Jersey City, N. J.

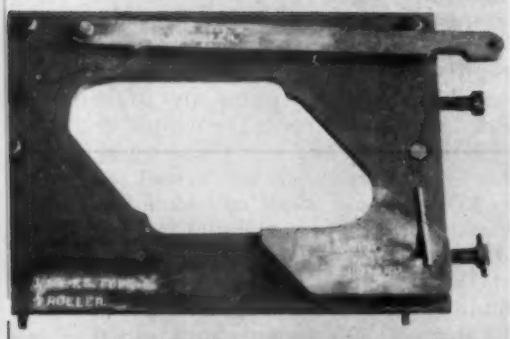


Fig. 1—Steel template required for cutting machines equipped with a magnetic-tracing spindle.

Fig. 2—Five sample shapes produced by using electronic tracing equipment. Each of these was cut in a single operation. The "iron dog" outline gives a clear indication of the cutting scope opened to industry by the new process.

Fig. 3 (right)—Electronic-tracing equipment as installed on a multiple-torch cutting machine.

THE success of the oxy-acetylene hand cutting torch left in its wake a strong demand for a mechanical means of accurately propelling the torch over the workpiece. It was evident that greater uniformity of work, higher rates of production and still further reduction in scrap could be realized if a machine designed to control torch movement were to replace the method of guiding the torch manually.

Early Flame-Cutting Machines

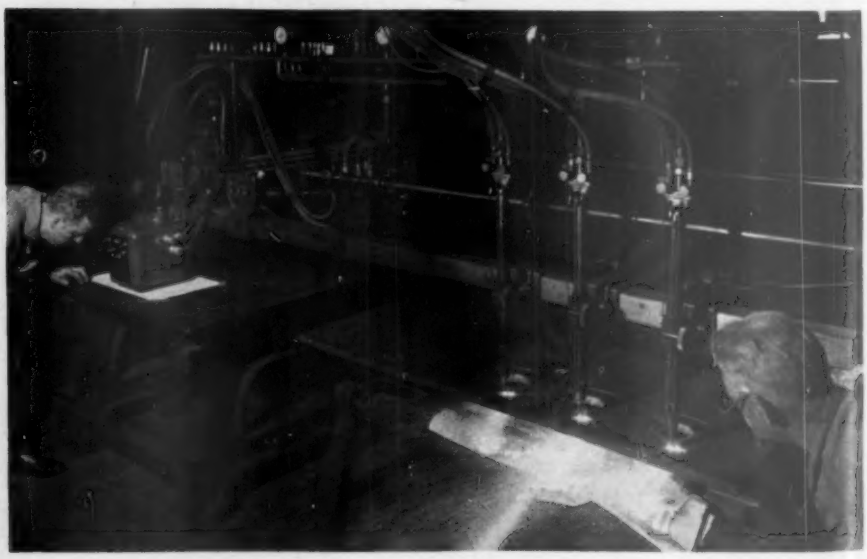
At the outbreak of the first World War, torch-guiding machines—relatively crude prototypes of the versatile models available today—began to appear on the market. One of the more popular of these early machines, a portable model, could cut either straight or curved lines. As plants became modernized for line production work, stationary machines were introduced to make possible multiple cutting, stack cutting or a combination of both.

Despite this progress, the methods of guiding the torch over the workpiece remained about the same. When the torch is not locked into position for straight-line cutting, its movement, is usually governed by one of three methods: (1) a manual tracing wheel guided over a drawing, (2) a tracing spindle guided around a wooden template or (3) a magnetic spindle guiding the tracing head against a steel template.

The first method, manual tracing, is generally employed when a limited number of cuts are required and template fabrication is not justified. The success of the manually guided tracing wheel is naturally dependent on the ability and skill of the operator. A high percentage of waste due to human error and operator fatigue sometimes occurs when complex cuts are encountered.

Template Disadvantages

The other two methods depend on hand-made templates, and these must be constructed with due allowance for such factors as spindle di-



Widens Scope of Flame-Cutting*

ameter and kerf width. For close-tolerance work, the tailoring operations require manual dexterity equivalent to that of the old fashioned cabinet maker. Furthermore, the most accurate templates are limited to the ability of the tracing device to follow the template contour. It is thus impossible to cut complex shapes to exact specifications without elaborate jigs and considerable machining—the disadvantage is particularly evident when inside and outside corners are encountered.

Template preparation cannot be stressed too strongly as one of the factors tending to increase the cost of shape-cutting operations. It is generally conceded that the most accurate, most automatic form of tracing is accomplished with the magnetic spindle. To prepare a template for the magnetic tracer, a study must first be made to determine whether or not the final desired shape can be cut in one operation. Possibly certain intricate sections must be obtained by subsequent cutting. The next step is to determine whether an inside or outside template is required. The dimensions of the template must then be computed, making due allowance for roll diameter and kerf width. Provision must also be made for a lead-in slot and finishing finger (such as is employed when cutting circles to avoid piercing on the cut line).

A drawing incorporating all of these requirements is prepared. The resulting outline must then be machined in plate steel to reasonably close tolerances. It is evident that large-quantity production is required to offset the cost of such template preparation. A typical example of a magnetic template is shown in Fig. 1.

In addition, proper template storage requires valuable floor space. Special storage techniques and frequent inspections are also necessary, especially when templates are fabricated from wood, aluminum or other soft materials.

Much literature has been written and much thought expended in attempts to simplify or standardize template procedure, but this operation remains essentially a special job, requiring exacting workmanship each time a new pattern is to be cut.

Drawings Instead of Templates

Electronically controlled tracing equipment opens an entirely new field in machine flame-cutting. Instead of following metal or wood templates, electronic equipment traces automatically from outline drawings or silhouettes. The electronic-tracing head will follow the most complex drawings, reproducing angles and curves with extreme accuracy regardless of whether the order calls for 1 or 100 shapes to be cut.

Since paper templates can be prepared at low cost, small parts and complex shapes can be economically shape-cut with standard pantagraph machines. The two shapes shown in Fig. 2 were each cut in a single operation from silhouettes. These designs would be impossible to reproduce

*Abstract of a paper prepared in conjunction with the twenty-sixth annual meeting AWS, Oct. 17, 1945.

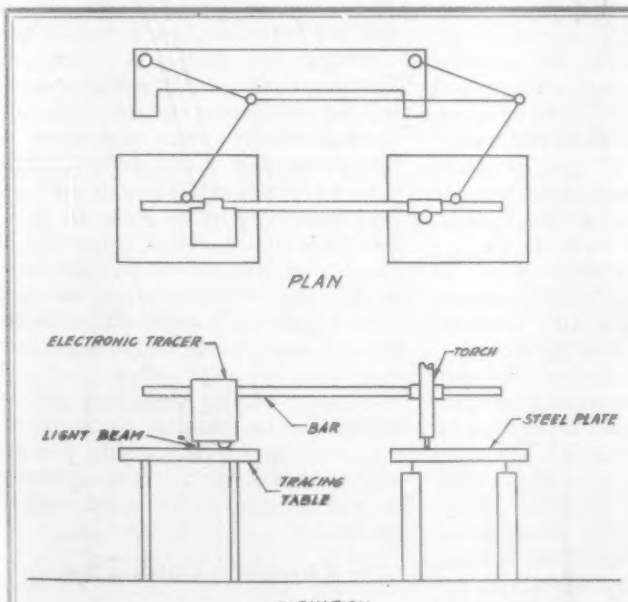


Fig. 4—Plan view and elevation of cutting equipment illustrating the relation of the electronic-tracing head to the torch.

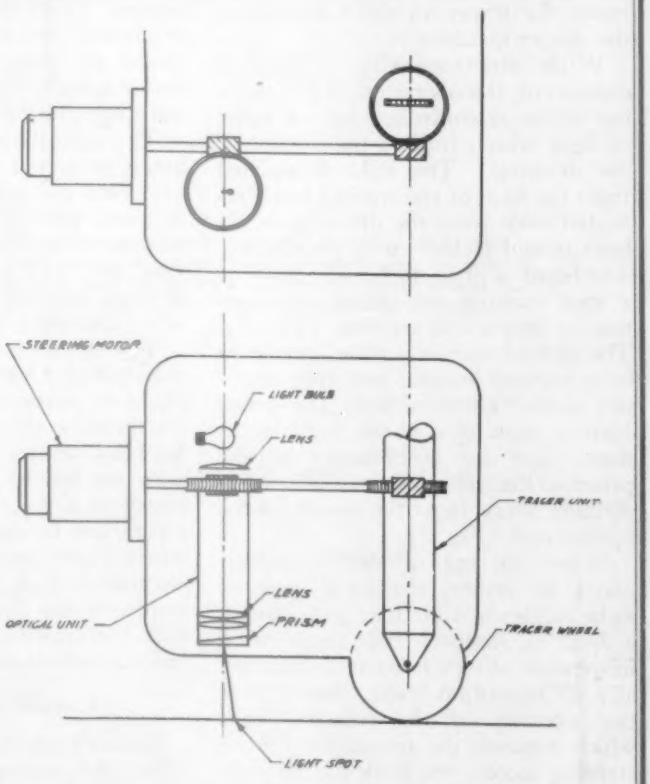


Fig. 5 (right)—Arrangement of optical unit tracer spindle, steering motor and worm-gear drive in the tracing head. Note how the light spot is deflected—approximately 3/32 inches from the true center of the optical unit.

with any other standard tracing device.

The application of electronic control to oxy-acetylene machine cutting is the product of extensive research conducted by General Electric and Air Reduction in an effort to adapt all phases of oxy-acetylene shape cutting to postwar production requirements.

A multiple-torch cutting machine equipped with this electronic-tracing device is pictured in Fig. 3. The equipment consists of two units: the tracing head and a control box. The tracing head is a self-contained unit that replaces the manual or magnetic device and is attached in the same manner to the bar on standard pantagraph-type machines. No modifications or alterations to the machine are necessary. Plan and elevation views of this arrangement are given in Fig. 4. The control box is attached to the machine base.

How It Operates

Nearly everyone acquainted with machine flame-cutting is familiar with the conventional type of manual-tracing device in which the driving wheel is rotated by means of shafts and gears motivated by the tracer motor positioned at the top of the unit. The direction of travel is affected by rotation of the driving wheel about a vertical axis. In manual shape-cutting, the operator is called on to steer or rotate the tracer an exact amount at the proper instants.

With electronically controlled equipment, the operation of the steering motor is controlled by the beam of light which follows the outline of the drawing. The light is emitted from the base of the tracing head, reflected back from the drawing or silhouette and picked up by phototubes. The beam is projected in the form of a spot through an optical unit containing lenses and a prism (Fig. 5). The optical unit is a tube supported by a vertical bearing and free to rotate about its vertical axis. The lenses form a light spot about 3/32 in. in diam, and this is deflected by the prism so that its center will be a short distance away from the center of the optical unit (Fig. 5).

When the optical unit is rotated about its center, the small spot of light rotates in a circular path having a 3/32 in. radius. This freedom of movement allows it to seek continually to reposition itself. Since it is the intensity of the reflected light which controls the movement of the steering motor, the drawing must be made in black against a white background, or in another color combination of sufficient contrast.

Light Steers Tracer Wheel

The reflected light, picked up by phototubes, produces an electric signal, which is amplified to provide the current that flows through the steering armature and causes its rotation. The strength of the signal depends upon the intensity of the reflected light. If the light spot is directed entirely on the black area, much light is absorbed and a weak signal is produced. Conversely, if the spot is directed on the white background, most light will be reflected back to the phototubes, producing a strong signal.

When the tracing head is following a straight line, the light spot remains centered, half on the black area and half on the white background, as shown in Fig. 6. The steering motor is so adjusted that when this condition exists, no rotation of the steering motor armature takes place.

If more than half of the spot of light should cover the black area (Fig. 7), the resultant decrease in signal strength will cause the steering motor armature to rotate both the optical system and the tracer spindle in a counterclockwise direction until equilibrium has been restored.

In the same manner, if the light spot should tend to leave the black outline and more than half the spot became centered on the white background (Fig. 8), the strong signal produced would cause the steering motor to rotate optical system and tracer spindle in a clockwise direction until equilibrium has been restored.

The optical unit is free to rotate about its center in the same manner in which the tracing device rotates. A worm gear drive connects the optical unit and the tracing wheel so that they will rotate simultaneously an equal amount in the same direction when driven by the steering motor.

When a curved line is followed, the light spot will transmit a constant slight or strong signal, depending on the direction of the curve. The tracing head follows the curve evenly and, with the aid of an antihunt device, produces a smooth cut. Cumulative errors due to slipping of the driving wheel have been eliminated as the electronic-tracing head constantly compares the torch position directly with the drawing. This control provides a smooth, even corrective action.

Corner Difficulties

Square corners or sharp angles will effect the accurancy of the cut to some degree at high or low operating speeds. When the electronic-tracing device approaches a right-angle corner, the center of the optical unit is centered on the edge of the drawing as is the projected light spot. The torch tip at the other end of the pantagraph bar is in the same plane as the center point of the optical unit. Before turning the corner, the light spot must pass completely into the white field. The optical unit still remains centered on the edge of the drawing. Not until the light spot is back on the dark field does the center of the optical unit begin to leave the edge of the drawing. When the light spot is again centered on the edge of the drawing, the center point of the optical unit (which corresponds to the torch position) has rounded the corner and has passed beyond the horizontal side of the angle because of the inertia of the machine carriage.

When the operating speed is slow (as it would be in cutting heavy material), the position of the torch does not correspond to the true position of the light spot. However, there is not enough inertia to cause the driving wheel to skid, and consequently a cleanly rounded corner is produced.

At the fast operating speeds encountered when light material is cut, the increased inertia of the machine carriage does cause the driving wheel to skid when the turn is made. This produces a high spot at the corner. At average operating speeds, the cut will fall between these two extremes.

Except for very close tolerances, the corner produced at average speeds will be sufficiently square. The distance from the center of rotation of the optical unit to the deflected light spot is approximately $\frac{3}{32}$ in.—even if that distance were as great as $\frac{1}{8}$ in., the error of the actual cut would be $\frac{1}{32}$ in. or less. Actually, the error is still further reduced as the high spot is partially burned off by the increased heat which builds up at corner cuts.

A more precise operation may be secured by building up the corner of the drawing to compensate for the high spot, but this minor modification is not necessary for most cutting operations.

No Change in Cutting Speeds

It is well to mention that the actual speeds of cutting with electronically controlled equipment correspond to the speeds of machines equipped with conventional tracing devices. The speed is preset for the given thickness before the start of the cut and remains constant during the entire operation.

Fig. 6—Operation of tracing head when following a straight line. The light spot is centered, half on the black outline and half on the white background. When this condition exists, no rotation of the steering motor armature takes place.

The electronic tracer head consists of the optical unit, the tracing device, two photoelectric tubes, an amplifier tube, light bulb and potentiometers. A direction indicator, switch panel, adjustment controls and the necessary electrical connections are also included. The electrical units and optical unit are housed in dust-tight chambers. Three motors are provided to control the movement of the tracing head movement—steering motor, tracer driving motor and the motor which raises or lowers the head.

Switches for Easy Control

A vertical track guides the tracing head when the unit is raised or lowered. Fingertip control assures responsive operation, and the unit may be raised above the table to any desired level by merely lifting the handle of a momentary contact switch or lowered to rest on the table by means of the same switch.

The governor-controlled motor which operates the tracing wheel assures a wide range of speeds to include all thicknesses of material from very light plate to very heavy sections. Absolute control of the cutting speed is assured by a tachometer. An observation window provided in the front face of the tracer head enables the operator to observe the light spot for alignment with the starting point.

The control switches are mounted on the front face of the tracer head. A single-pole switch controls the motor of the tracing device, and a momentary contact switch raises or lowers the tracer head. The scanning head is raised by lifting the switch handle and lowered by depressing this handle. Movement of the tracing wheel may be preset through a momentary contact job switch; it is possible by means of this switch to position the tracing wheel at any desired angle. A manual-and-automatic switch is also provided to switch off the electronic control during manual operation or to set the machine on automatic for electronic operation. Two potentiometer knobs adjust the operation of the steering motor.

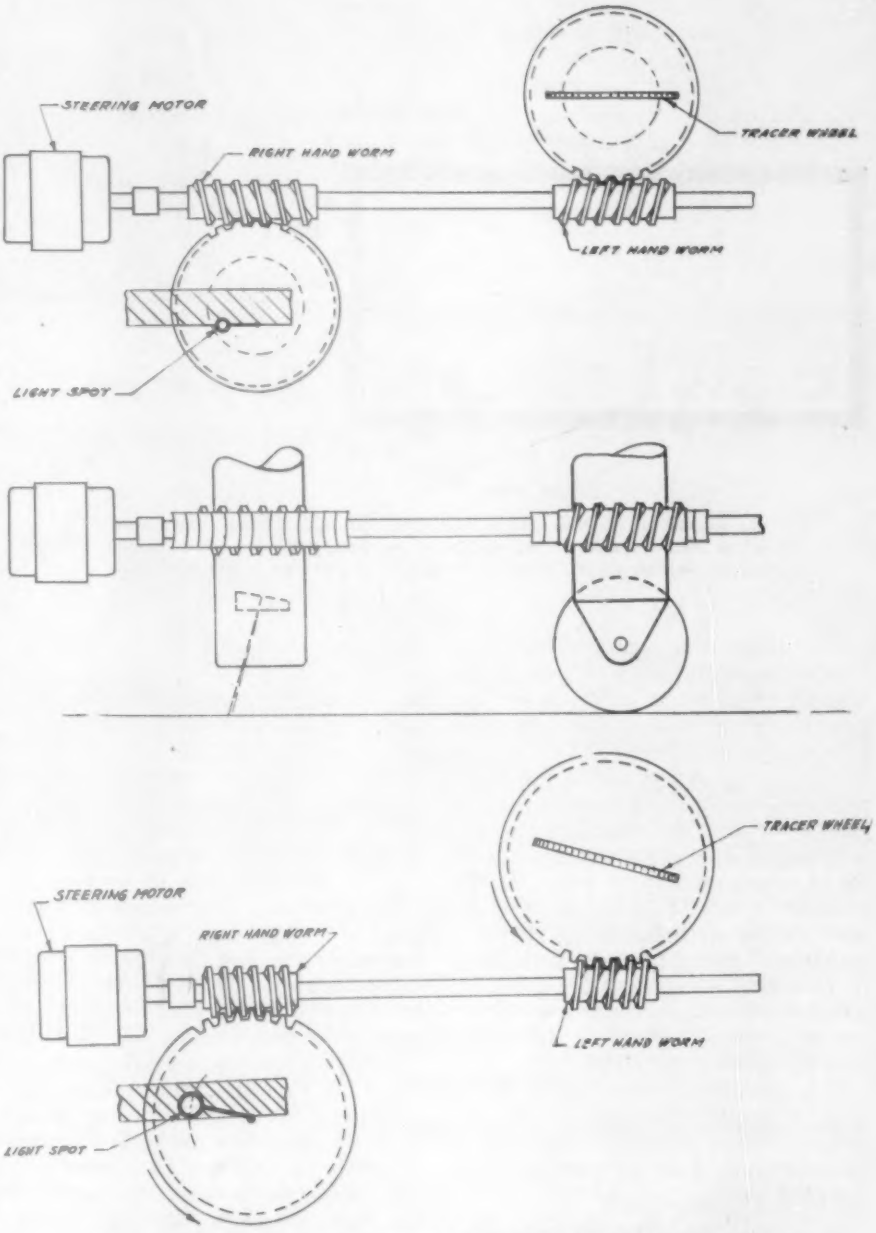


Fig. 7—Operation of steering motor when more than half the spot of light is directed on the black outline. Decreased signal strength causes the steering motor armature to rotate both the optical system and the tracer spindle in a counterclockwise direction until light equilibrium has been restored.

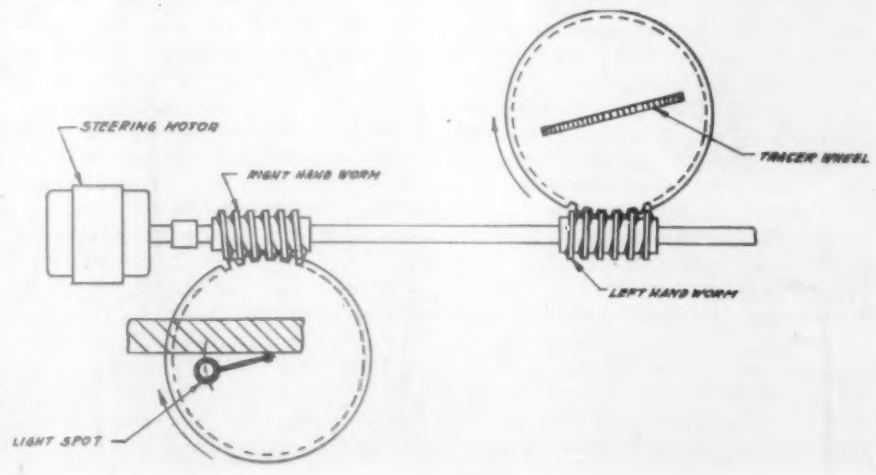


Fig. 8—Operation of steering motor when more than half the light spot becomes centered on the white background. Increased signal strength causes the steering motor armature to rotate both the optical system and tracer spindle in a clockwise direction until equilibrium has been restored.

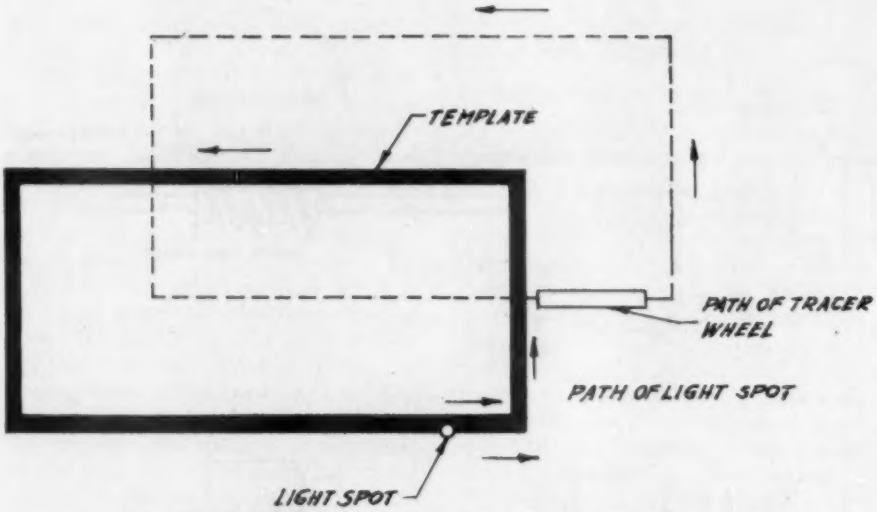


Fig. 9—Path of the light spot in relation to the tracing wheel. The tracing wheel does not traverse the outline of the drawing except where it may happen to intersect it. Wear or damage to the drawing is thus minimized.

The direction indicator gives visual indication of the angle at which the tracing wheel is set. This would be hard to determine with the naked eye as the clearance between the bottom of the tracing device and the tracing table is small to prevent outside light interference. The dial face of the indicator is calibrated to conform to the numbers on a clock face. If the indicator reads 12 o'clock, the tracer head will move directly away from the operator's normal position. Similarly, if the indicator registers 6 o'clock the tracer head moves directly toward the operator, and 3 o'clock it will move directly toward the right.

It is possible to trace either clockwise or counterclockwise, and the direction desired may be predetermined by positioning a switch provided for this purpose.

Drawings Must Have Contrast

Drawings or silhouettes for electronic tracing are easily prepared by a variety of methods from paper, cardboard or plastic material. Black ink or heavy pencil lines on white paper, silhouettes inked on a white background, the paper-doll method of mounting a design cut from black paper on a white background have all produced excellent results. Although the black-on-white combination (or vice versa) is recommended, other color combinations may be used if they provide sufficient contrast. Exposed blueprint paper mounted on a white background has been successful.

If the inked line for an outline drawing is less than ⅛ in. wide, it should be backed up by a heavy pencil line. In establishing the dimensions of the drawing or silhouette, an allowance for kerf width must be borne in mind.

One of the most interesting features of this reproduction method is the "lead-in line," which can be a strip of black paper laid on the drawing so that the electric eye will follow it into the outline. The strip may be removed as the cut progresses.

Dark smudges will, of course, effect the contrast upon which the electric eye is dependent to produce true reproductions. For this reason drawings which are to be used often should be protected with a coat of clear lacquer or by cementing a thin sheet of transparent material over the surface. Wear or damage to the drawing is minimized because the tracing wheel does not track over the outline except where it may happen to intersect it. The difference between the path of the light spot and the path of the tracing wheel is depicted in Fig. 9.

The cost of preparing drawings or silhouettes for electronic tracing is exceptionally low as compared to conventional templates, and still further economy is derived from the simplified storage requirements. A boon to every machine-cutting department is the speed with which these drawings and silhouettes can be prepared. Another advantage is the ease with which alterations may be made—particularly important when small dimensional changes are to be made in a part.

Another outstanding advantage in connection with smaller pieces is found in the chain method of reproduction. By this is meant reproduction of the outline in series as illustrated in Fig. 10. The separate outlines are joined with a line that enables the cutting to be continuous.

Progressive positioning of drawings may be employed when the same outline is to be repeated for relatively long lengths. This is accomplished by simply picking up the drawing that has been scanned and repositioning it for the tracing head to follow again.

Accurate Curves on Steel Lady

The accuracy of electronic tracing is within a very few thousandths of an inch. During a test, the tracer head automatically traced over a drawing of a rectangular design for several continuous hours, using a scribe in place of a torch. No appreciable change in the width of the line scribed on a chalked plate could be observed, and no difference in measurement between the drawing and the scribed line could be detected.

Extremely difficult and intricate corners presented no tracing problems. Tests were conducted with various types of drawings and silhouettes to determine the ability of the electronic-tracing head to reproduce any design faithfully. An artistically drawn bathing beauty was tried (Fig. 10); the lady in steel possessed all the charm and appeal of the original silhouette.

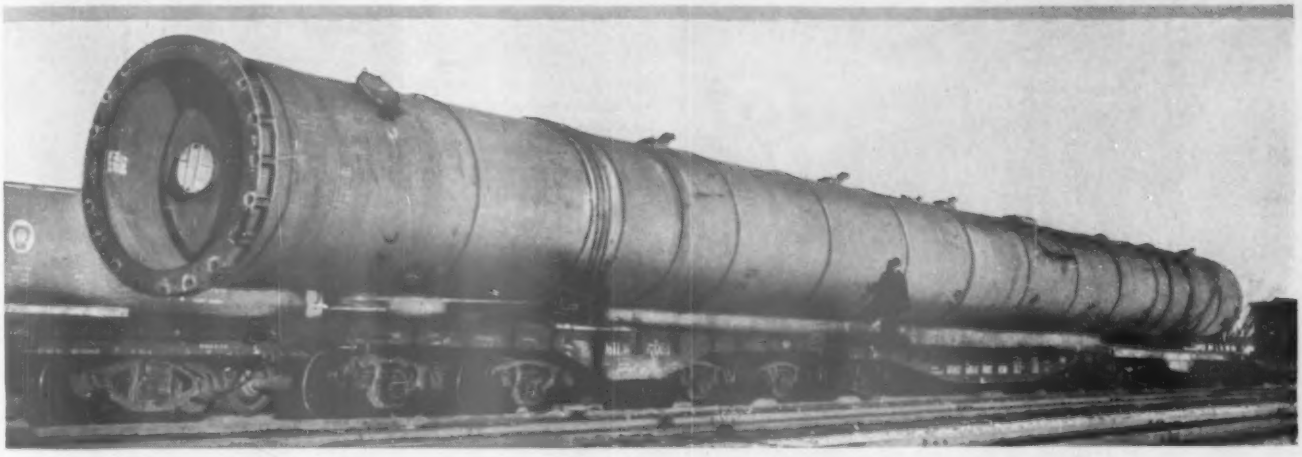
To summarize, electronically controlled cutting possesses flexibility, accuracy, economy and quality. Intricate shapes or contours may be cut to dimension. Rapid manual movement from point to point to facilitate lining up of the drawing is assured through control switches. Ease of drawing or silhouette preparation makes possible complex design reproductions, and the chain cutting technique opens up new avenues to increased production.

Fig. 10—Silhouettes illustrating the chain method of cutting. By duplicating the drawings, the cutting operation will be continuous for several cuts of the same pattern. Drawings may also be repositioned to effect the same result (see text).

1925

The first SMITHway pressure vessel established an electric arc-welded construction that overcame the most serious industrial hazards ever known in the petroleum industry.

In 1925, *the First* . . . In 1946, *the Largest*



1946

Twenty-one more years of unending welding research, makes possible today this single-piece 160-foot 446,000-lb. deisobutanizing tower; a SMITHway vessel which produces 652,000 gallons per day of butane.

ACTUAL shop production has proved SMITHway Certified Welding Electrodes from the day they were first developed. A. O. Smith plants use more than 320,000 a day; millions more are used by other manufacturers.

This wealth of production and application experience has been paralleled by continuous welding research in A. O. Smith laboratories. Each year since 1917 has seen the development of improved SMITHway Electrodes. Each year has seen these electrodes employed by A. O. Smith to pioneer the welding of every type of steel product . . . small, simple products no less than structures weighing up to half a million pounds.

For detailed specifications of SMITHway Certified Electrodes and their application to specific welding jobs, send for the SMITHway Welding Guide.

Mild Steel . . . High Tensile . . . Stainless Steel

WELDING ELECTRODES

made by welders . . . for welders

SMITHway A.C. Welders

Six models, including three new models of 150-, 200-, and 250-ampere capacity. Heavy Duty Models of 300-, 400-, and 500-ampere capacity. Write for complete specifications and prices.

SMITHway Certified WELDING ELECTRODES

A. O. SMITH Corporation

NEW YORK 17 • PITTSBURGH 19 • CHICAGO 4 • TULSA 3
HOUSTON 2 • DALLAS 1 • LOS ANGELES 14 • SEATTLE 1
INTERNATIONAL DIVISION: MILWAUKEE 1 • In Canada: JOHN INGLIS CO., LIMITED

On the Job

Arc-Welding Jeep

A CIVILIAN jeep for arc welding has been developed by Willys-Overland Motors, Inc., Toledo, O. According to Delmar G. Roos, Willys-Overland vice-president in charge of engineering, this type of jeep should have appeal for contractors, public utilities, municipalities, railroads and returned veterans who want to set themselves up in the welding business. Broken farm machinery can be repaired in the field, or the jeep can keep pace with pipe lines over terrain which cannot be traversed by ordinary trucks.

The arc-welder jeep proved its worth in war for quick repairs to tanks and airplanes. Now it is being made available to industry and agriculture.

The welding generator is powered by the jeep engine and uses slightly better than a gallon of gasoline per hour. The rated capacity of the generator is sufficient to handle electrodes up to ¼ in. in diameter.

» «

Cups for Nuclear Debris

THE fabrication of tank units needed in the manufacture of atomic bombs was hastened by about 30 days because of automatic arc welding. These tanks were designed to receive and store the dangerously radioactive residual matter that remained after "atom-harnessing" operations. They were fabricated inside a concrete form at the job site, and the top of each unit was formed in concrete after welding, thus completely encasing the tank structure with a heavy concrete insulation. As a further precaution against the radioactive emanations, the tanks were buried in the earth.

A fabricating procedure was required that would render the structures absolutely leakproof and airtight. Manual arc welding could not be used successfully because of the peculiar formation of the large cup-shaped bottom. Plate gaps at the joints varied up to about ½ in., and plate distortion was excessive. The allowable distortion was less than 1%, and the methods ordinarily used to control distortion could not be utilized because of the concrete backing of the bottom sections.

Twelve tanks—erected at one of the three closely guarded atomic-bomb plants—measured 75 ft in diameter and stood approximately 15 ft high. These units were supplemented by four smaller tanks of 16-ft diameter. The steel plates used for this job were ¼ and ⅜ in. thick and measured approximately 6 by 20 ft. The shell and bottom sections were formed and fused into single large cups to hold the nuclear debris.

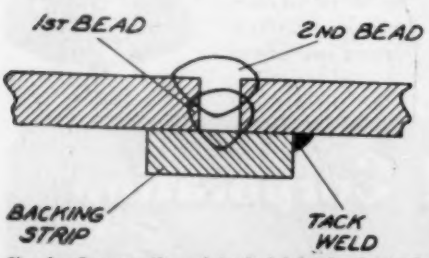


Fig. 1—Cross-section of typical joint in the tank structure. The backing strip was tack welded to the plate on the right before the sections were placed in the concrete shell. Note the depth of penetration secured by the two beads.

Photos Courtesy, The Lincoln Electric Co.

Fig. 2—The tractor-type automatic welding unit. Bare welding wire was used, the flux being deposited on the joint ahead of the arc.

Under the procedure developed for automatic arc welding, the plates were prepared by tack welding ¼-in. backing strips along one end and one side of each section (Fig. 1). The strips extended halfway beyond the edge of the plate. When the sections were placed in their relative positions in the concrete shell, one sheet overlapped the backing strip tack welded to the adjoining sheet. Concrete blocks measuring 1 by 4 by 10 ft were placed approximately 10 in. apart on each side of the joint to hold the plates in position. Further efficiency in fit-up was obtained by utilizing clamping jacks similar to those with which shipyard weldors are provided.

First, the ends of the plate sections were butt welded. Normally, two passes effected 100% joint penetration. The beads were extended slightly beyond the ends of each seam.

The welding equipment used is shown in Fig. 2. It includes welding head, wire reel,

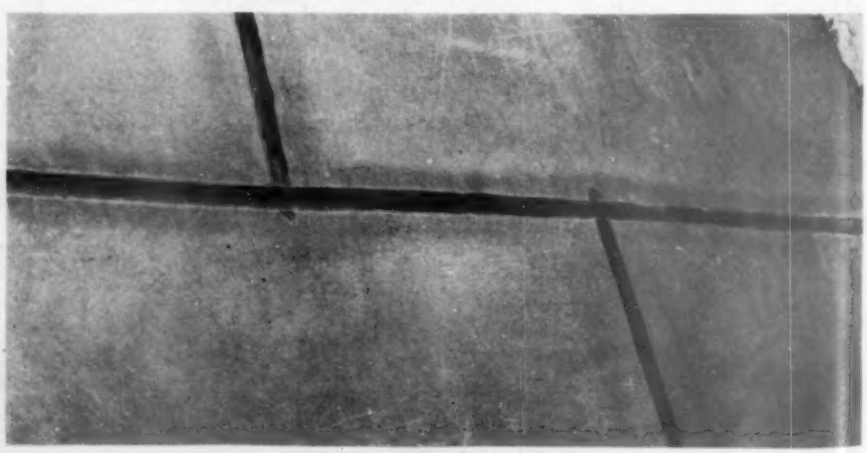


Fig. 3—This close-up of finished work shows the uniformity of the welded seams.

flux container and control box—all mounted on a motor-driven tractor.

After butt welding the ends, the welding head was positioned for the longitudinal seams. The successive welds started at the center of the structure and proceeded outward to alternate ends of the plates. Thus the first sealing beads were applied in a staggered sequence, first right, then left of center. The welds penetrated about ⅛ in. into the backing strip as shown in Fig. 1. With normal fit-up, only two passes were required.

Finish welds were also started at the center seam, and the work progressed in sequence from center to right, then from center to left.

Welding speeds for the first pass were made at the rate of about 36 in. per minute, using ⅝-in. bare-wire electrodes. The machine was set at 650 amp, 31 volts. For the finish weld the same welding speed and same size of wire were used, but the settings were 625 amp and 34 volts.

Fig. 3 shows the dense, uniform weld beads as deposited on a typical section. All joints were required to pass rigid X-ray examinations for porosity or other defects.

» «

Welded Checker's Truck

A NEW type of stock checker's truck which contains a conveniently placed writing table and stationary rack is being made by Palmer-Shile Co., Detroit 17. This product is of welded steel construction. The three sheet-steel shelves are formed with a 1-in. flange all around, and the tubular handle is positioned to form a protective bumper for the stationary rack. The truck is fitted with four rubber-tired castors.

The overall height is 42½ in. to the top shelf, 50 in. to the top of the writing table. Floor clearance is 9½ in. The distance is 18 in. between the lower and center shelves and 12 in. between the center and top shelves. The writing table is 20 in. wide by 14 in. deep, and the stationary rack is 20 in. wide by 8 in. high in front.

This all-welded truck was designed specifically for use by stock checkers. Note the writing table and stationary rack.

Double Deoxidized
Welding Rod

AN *Exclusive* TITAN PRODUCT

Double Deoxidation eliminates one of the most serious hazards incident to welding—the presence of occluded or dissolved gases within the rod itself, and the possibility that gases will be absorbed from various sources during the welding operation.

You will have none of these troubles when you weld with Titan Bronze Rod. You will secure free permeation of smallest cracks and seams, and a finished job that will be sound, strong, non-porous and highly ductile.

Informative Literature

Titan Welding Rods are available in various Bronze alloys providing for practically any welding requirement. Write for Titan literature on this subject which approaches from the angle of Welding Rod characteristics and also welding job requirements. Metallurgical assistance if desired.

Titan

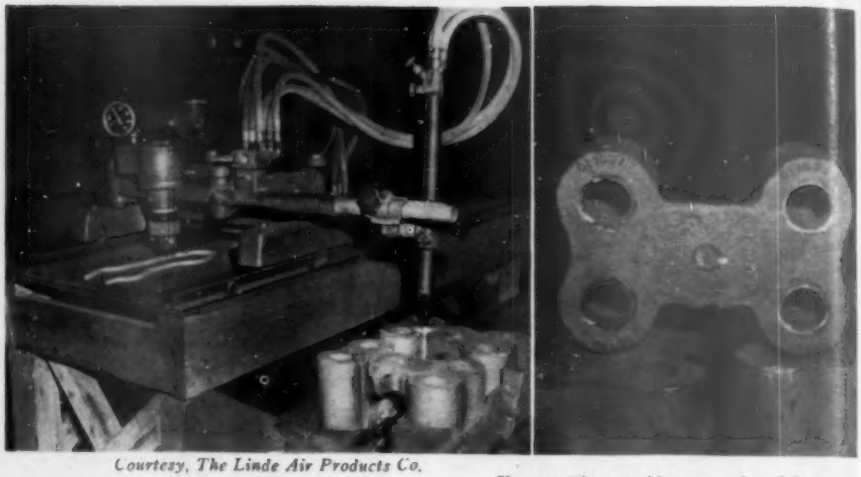
METAL MANUFACTURING CO., BELLEFONTE, PA.
Sales Offices:
New York—39 Cortland St.
Chicago • San Francisco • New Orleans
Export Office—70 Pine St., New York 5, N. Y.

Quality Alloys By Brass Specialists
Brass and Bronze Rod • Forgings • Die Castings • Welding Rods

Shape-Cutting in Foundries

FOUNDRIES making castings on a production basis are finding mechanized shape-cutting an excellent method of removing the diversified risers and gates involved in the casting process. Shape-cutting reduces the amount of grinding required per casting, and the use of a template-guided machine permits a semiautomatic procedure for repetitive cutting operations.

The set-up pictured was used by one foundry to cut gates on return bends used in refinery piping. These steel fittings are cast in clusters, each consisting of a pair of bends connected by a gate 5 in. wide and 3 in. thick. Two castings (four fittings) are clamped side by side in a jig, and a standard template of aluminum strip is used to guide the machine through the four cuts which are necessary to separate the fittings.



Courtesy, The Linde Air Products Co.

Flame-cutting machine removing 3-in. gates from steel castings for return bends. An aluminum-strip template automatically guides the machine through the cuts. To the right is a pair of return bends as cast.

The cuts are made in a continuous cycle in less than 10 minutes, a cutting speed of 10 in. per minute being obtained through the 3-in. steel. Seven dual set-ups can be accommodated per hour, amounting to a production rate of 224 return bends separated per day. Very little material is left for the grinders.

» «

Welded 914-mm Shells

WELDING helped to produce two-ton shells, 36 in. in diameter, which were never used because the war ended. This shell was in production at the Barberton, O., plant of The Babcock & Wilcox Co. and would undoubtedly have been employed against both Germany and Japan had our foes managed to hold out a little longer.

The shell was designed for a 914-mm mortar, the largest cannon in the world, called familiarly the "Little David." Having a range of six miles, this giant piece of ordnance was designed specifically for one purpose: to batter down 10-ft-thick concrete fortifications.

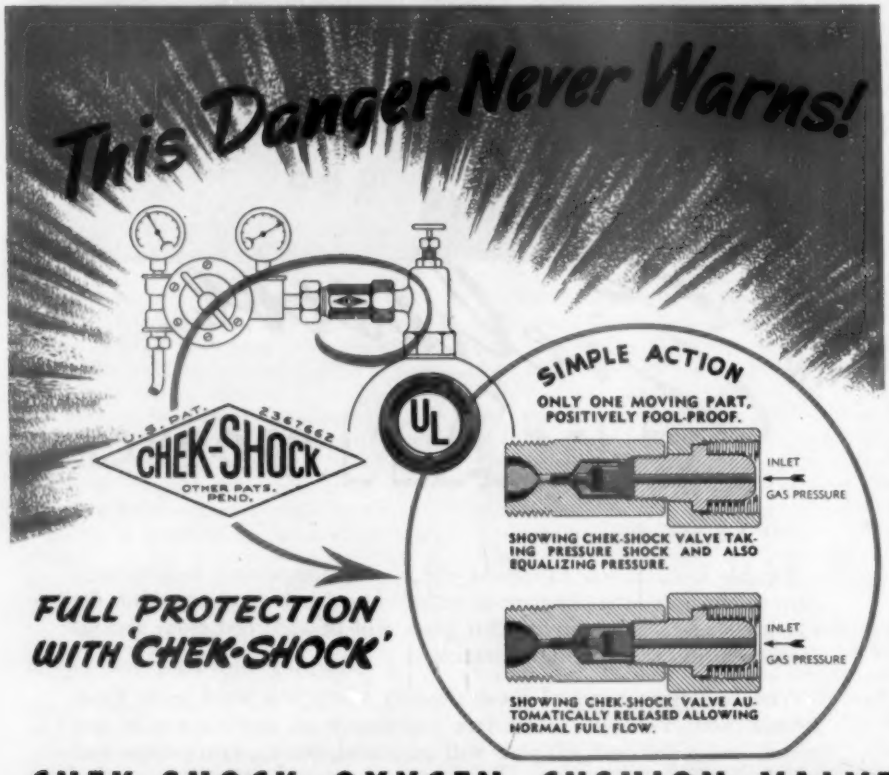
A special chrome - manganese - vanadium steel of 120,000 psi tensile strength was forged for the body of the shell. Prior to welding on the head, the body was machined inside and out to close tolerances. Because of the unusual grade of steel, precise welding techniques were developed to attach the head at the front of the shell.

To obtain better ballistics and greater range, an aluminum ogival projectile nose was fitted over the head. The ogive sections were pressed in two halves, welded and ground for smooth contour.

» «

Veterans and Fire Safety

AFTER a bomber or a foxhole, the returning veteran may be somewhat scornful of industrial safety precautions. He should be given a "refresher course" in fire safety, suggests Safety Research Institute, Inc. A tour of the plant in the company of the safety engineer or foreman will also help to dramatize the importance of stopping fires before they start.



CHEK-SHOCK OXYGEN CUSHION VALVE

SOFTLY controls the vicious "jolt" of high pressure oxygen gas, thus eliminating regulator repairs and preventing possible injury to operators.

- **Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.**
- **Will increase life of regulator assembly.**
- **Will eliminate possible injury to operator from burstings.**
- **Will prevent unnecessary internal wear in regulator *(as NOT necessary to release control screw before opening tank valve).***

This PROVEN automatic safety device cushions the initial "blast" of pressure when tank valve is turned on, (this uncontrolled surge which strikes like a hammer is the direct cause of most damaged regulators and accidents), when pressure slowly bleeds and equalizes then CHEK-SHOCK allows a full flow of oxygen.

PRICE IS LESS THAN ONE REPAIR BILL

 # 1. STANDARD COUPLER—for all standard size welding type oxygen regulators.
 # 2. LIGHT COUPLER—for "airplane" or soldering size oxygen regulators.
 # 3. HEAVY DUTY COUPLER—recommended for extra heavy duty work only.
 # 4. SCREW TYPE COUPLER—for removable inlet stem regulators (¼" pipe) available in standard, light, or heavy capacities.
 # 5. FOR HYDROGEN—left hand thread coupler. We also make Medical Chek-Shocks for all types of medical regulators and tank fittings (chrome plated).....$7.00 each

$6.00 ea.

SEE YOUR DISTRIBUTOR OR WRITE

Chek-Shock MFG. CO.
FOWLER CALIF.

MARTIN WELLS' *Stubby* HOLDER

Gives more ARC time

100% Insulated; Cuts Down Accidents

1. Stubby, with new "Mitt-Grip" collar, makes rod changing easier and quicker. Collar lasts indefinitely. Insulator cap may be replaced without changing collar and without special tools. So, Stubby spends more time on the job, less in the repair shop.

2. Higher electrical conductivity, due to special construction of vise body, delivers *full amperage* to the rod. Sturdy, but lightweight construction protects Stubby when overloaded.

3. Stubby's perfect balance, due to streamlined design and light weight, helps operator maintain high weld-footage throughout the shift. Because it is 100 per cent insulated, Stubby does not have accidents.

4. Stubby's high pressure grip holds rods firm, enables operator to use rods down to the last 1½". Stubby has no springs to get tired.

***Stubby* WILL GIVE YOU MORE ARC TIME**

WRITE OR WIRE NEAREST DISTRIBUTOR

Atlanta—Air Reduction Sales Co.
Baltimore—Air Reduction Sales Co.
Bay City—Northern Supply Co.
Bettendorf—Air Reduction Sales Co.
Birmingham—Air Reduction Sales Co.
Ebbert & Kirkman Co., Inc.
Boston—Air Reduction Sales Co.
Buffalo—Air Reduction Sales Co.
Cedar Rapids—L. B. Lamb Sales Co.
Central Falls—Air Reduction Sales Co.
Charlotte—Air Reduction Sales Co.
Chicago—Air Reduction Sales Co.
Steel Sales Corp.
Cincinnati—Air Reduction Sales Co.
Williams & Co., Inc.
Cleveland—Air Reduction Sales Co.
Williams & Co., Inc.
Columbus—Air Reduction Sales Co.
Williams & Co., Inc.
Corning—Air Reduction Sales Co.
Davenport—Air Reduction Sales Co.
Dayton—Air Reduction Sales Co.
Detroit—Air Reduction Sales Co.
Steel Sales Corp.
Weldit Incorporated
Duluth—Air Reduction Sales Co.
Emeryville—Air Reduction Sales Co.
Erie—Air Reduction Sales Co.
Flint—Air Reduction Sales Co.
Grand Rapids—Air Reduction Sales Co.
Harrisburg—Air Reduction Sales Co.
Honolulu—Hawaiian Gas Products, Ltd.
Houston and throughout Texas—
Magnolia Airco Gas Products Co.
Huntington—Air Reduction Sales Co.
Indianapolis—Air Reduction Sales Co.
Jersey City—Air Reduction Sales Co.
Kansas City—Air Reduction Sales Co.
Lima—Air Reduction Sales Co.
Milwaukee—Air Reduction Sales Co.
Steel Sales Corp.
Minneapolis—Air Reduction Sales Co.
Steel Sales Corp.
Mobile—Air Reduction Sales Co.
Montreal—Rudel Machinery Co.
Nashville—Air Reduction Sales Co.
New Orleans—Air Reduction Sales Co.
New York—Air Reduction Sales Co.
Chicago Combustion Co.
Oklahoma City—Air Reduction Sales Co.
Omaha—The Balbach Co.
Fuchs Machinery & Supply Co.
Philadelphia—Air Reduction Sales Co.
Phoenix—Arizona Welding Equipment
Pittsburgh—Air Reduction Sales Co.
Williams & Co., Inc.
Portland—Air Reduction Sales Co.
Richmond—Air Reduction Sales Co.
Rochester—Air Reduction Sales Co.
Saginaw—Northern Supply
Savannah—Bay Welding Sup. Co.
St. Louis—Air Reduction Sales Co.
Steel Sales Co.
San Francisco—Air Reduction Sales Co.
Pitts & Loughlin
Seattle—Air Reduction Sales Co.
Shreveport—Air Reduction Sales Co.
South Portland—Air Reduction Sales Co.
Spokane—Gibson Welding Supply Co.
Toledo—Air Reduction Sales Co.
Welder Service Co.
Tulsa—Air Reduction Sales Co.
Vancouver, B.C.—Scott-Foster & Co.
Warren—Air Reduction Sales Co.
Wheeling—Air Reduction Sales Co.
Wichita—Air Reduction Sales Co.

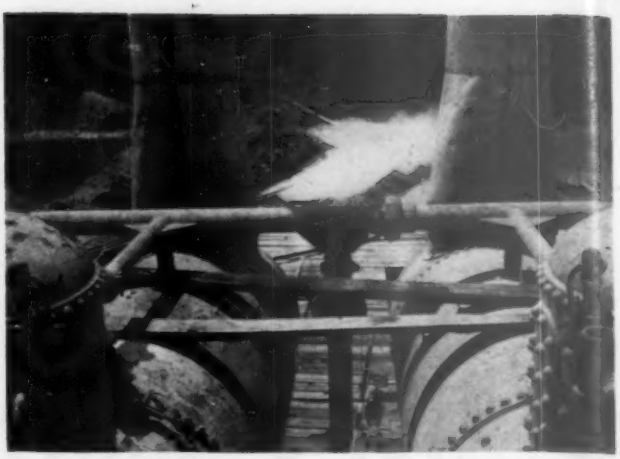
"More Arc Time"
Martin Wells
ELECTRODE HOLDERS
Los Angeles 1, California

Welded Steam Header

By Elton Sterrett

THE weldor for an oil-drilling contractor assembled a steam header which varies considerably from the usual type. Lying just above the boiler shells and just behind the stacks (see picture), this header is supported by the shells on short spuds or supporting legs. The legs are welded blind to the main, and fitted with rounded ends to prevent the boiler plate from being scored.

A lateral is welded above each leg and braced with triangular gussets in the horizontal plane. The laterals connect through spherical-joint unions with short nipples welded into the steam domes. This construction relieves the dome connection of torsion or thrust when the main line expands. The elongation between the taps is absorbed by flexure of the short laterals, and the bending is kept from the weld into the main by the reinforcing afforded by the horizontal gusset plates. To compensate for possible shift in the alignment of the shells, a spherical-joint union is cut into the center of the header, and a drop leg is welded in to one side of this union.



This "different" steam header is supported by short legs resting on the boiler shells. A lateral leads from each of the steam domes to the main.

This type of steam header uses a minimum of pipe, is easily disassembled for transport by breaking six unions and effects a weight saving of several hundred pounds over the conventional long sweeping curved sections connecting steam domes to the mains.

» «

Arc-Welded Ice Fighter

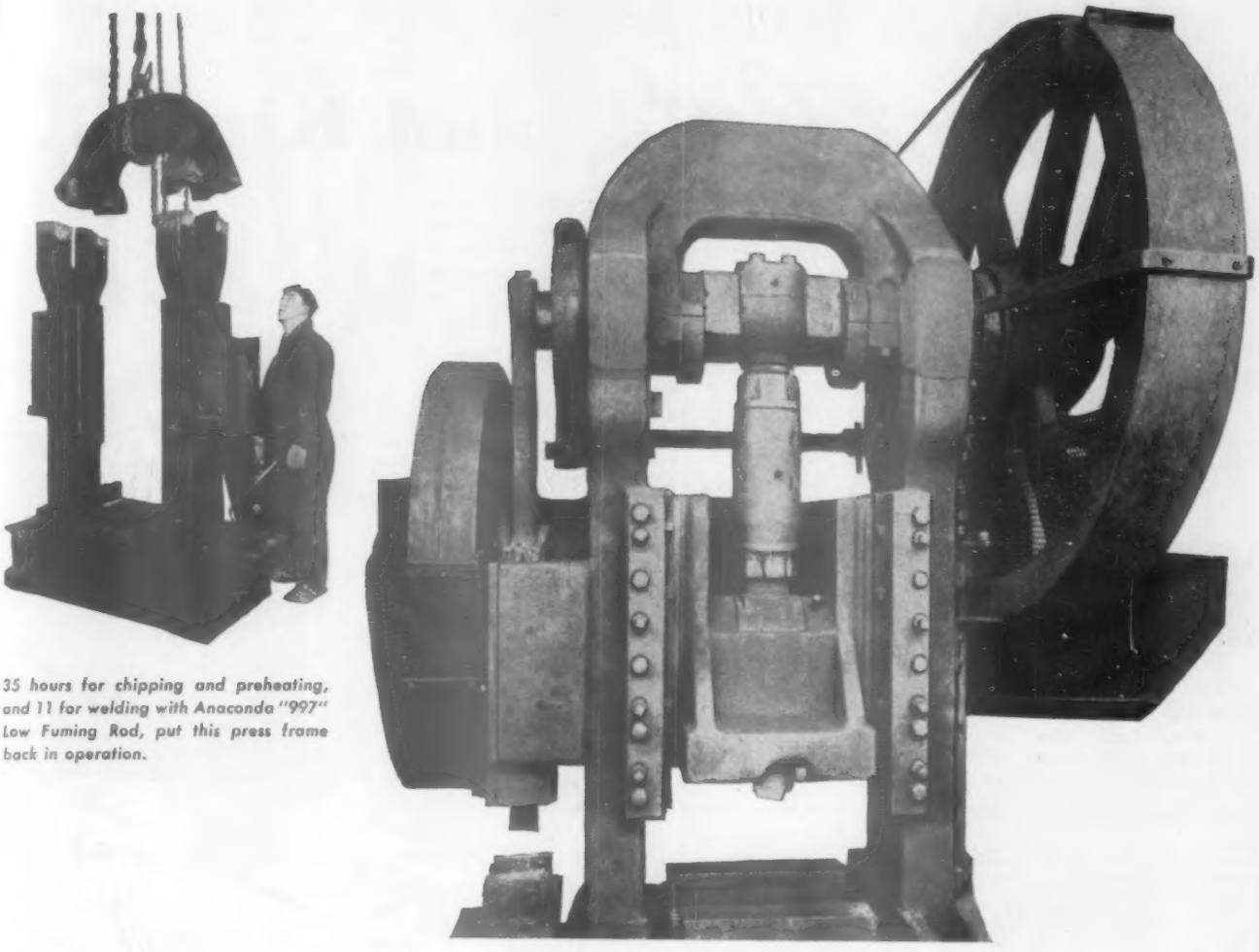
WHAT to do when Old Man Winter brings heavy snow and ice to block roads is shown in the picture below. This arc-welded machine, designed by Ray Ferwerda, president of The F. W. F. Corp., Cleveland, was photographed while clearing and widening traffic lanes near the Ohio metropolis. The hydraulically operated scoop quickly removed the four to five feet of packed snow and ice which had previously defied standard types of bulldozers and plows.

No stranger to snow and ice is Mr. Ferwerda, who received his first experience in shovelling snow as a boy in his native Holland. The necessity for keeping the canals clear for skating from one town to another led him to appreciate quick and efficient methods of snow removal.

Courtesy, The Lincoln Electric Co.

Welding made possible the building of this super snow scoop, shown in action near Cleveland.

SAVE TIME USE A
CMD
WELDERS CHIPPING HAMMER
With steel or wooden handle. Light weight. Strong. Easy to use. Write for circular.
TYPES EB and FB
Models E and F can be supplied with brush as shown here. Brush can be replaced by unscrewing countersunk screw in bracket and removing.
TYPE F
Head has two chisels at right angles.
TYPE E
Head has drift and chisel.
TYPE A
Has drift and chisel. Widely used in malleable and grey iron foundries for general chipping.
TYPE CB
Combines 3 tools in 1—drift, chisel and removable wire brush.
TYPE C
Same as Type CB, but without brush.
CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS



35 hours for chipping and preheating, and 11 for welding with Anaconda "997" Low Fuming Rod, put this press frame back in operation.

Don't wait Months for Replacement

...BRONZE WELD it in *Hours!*

EVEN on a bad break like this one, Bronze Welding can save weeks, perhaps months, of waiting . . . and in addition, the heavy cost of new replacement parts.

Bronze Welding is quick, economical, practical. You save on preheating and annealing time, and also on oxygen and acetylene.

Because of the lower temperatures employed, no serious stresses are set up, there is less possibility of warping or cracking, parts can often be welded without dismantling equipment, and intricate sections of cast or malleable iron, steel and copper alloys can be joined quickly and economically.

In addition to Tobin Bronze* and "997" Low Fuming, Anaconda Welding Rods are available in a range of compositions suitable for almost every gas or electric Bronze Welding purpose. For detailed information, write for Publication B-13, "Anaconda Welding Rods." 46190

*Reg. U. S. Pat. Off.

ANACONDA

Anaconda

BRONZE WELDING RODS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

Short Cuts and Kinks . . .

Easier Ways to Do Things

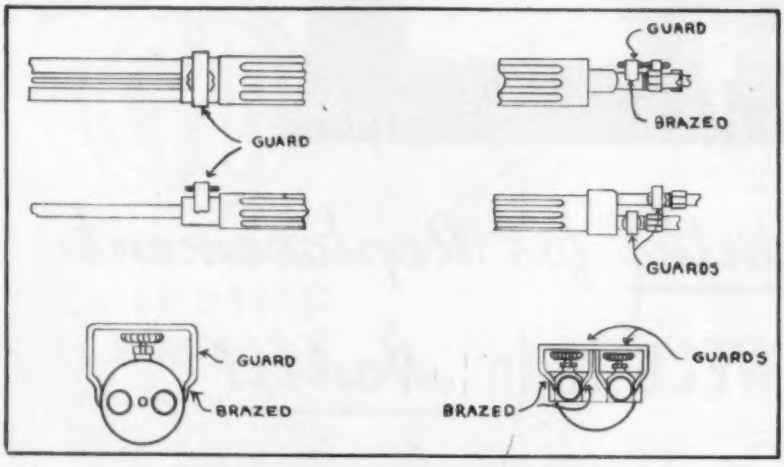
A few of the many time and labor-saving ideas developed by tacticians of the production line are presented every month in this department. If you have a good welding idea of your own to pass along, you are hereby invited to contribute it to this section. Send anything you think suitable to: Short Cuts and Kinks, THE WELDING ENGINEER, 506 S. Wabash Ave., Chicago 5. Payment will be made at our usual rates.

Torch Valve Guards

By Thomas Trail

I NOTICED that the flame of my cutting or welding torch was being frequently thrown out of adjustment because the control valves were moved accidentally. The mere brushing of the valves against my clothing was sufficient to disturb the torch adjustment.

I devised a rather simple guard to overcome this annoyance. When brazed in place over the valve knobs, this guard makes it practically impossible to move the valve accidentally. It was made by silver brazing a strip of sheet brass to a cutting or welding torch in the manner shown in the accompanying sketches.



Method of affixing Mr. Trail's valve guard to a cutting torch (left) and to a welding torch (right).

» «

Tube-Bending Device

By Carroll E. Adreon

A HAND-BENDING tool I designed permits us to bend all kinds of small tubing to any desired angle at the Glenn L. Martin Co., Baltimore. This tool has a sturdy steel base which may be used in a vise or clamped onto a bench, a grooved stop block to hold the tubing and a movable block connected to a radius rod equipped with a handle. The movable block is also grooved to receive the tubing; it is the function of this block to guide the tubing around a grooved bending roll centered on top the base. The roll has a top plate scribed in angular degrees.

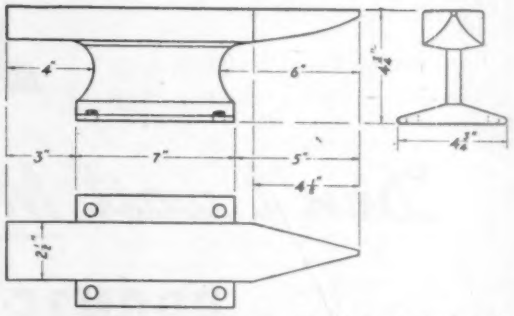
In operation, the movable block is first returned to the starting point, zero degrees. The tubing is then inserted in the grooves of the holding block and of the movable block, and the latter is pulled around the bending roll by the radius rod until the measuring point on the movable block is directly opposite the desired angle, as indicated by the scale on the roll.

The grooves in the two blocks and in the bending roll keep the tubing from being crushed or changed in section. Other advantages of the device are the great amount of time it saves over ordinary hand-bending operations and the extreme accuracy to which the tubing can be bent.

For tubing having a "spring back" characteristic, the measuring point is moved to as many degrees beyond the desired angle marking as the tube will spring back when released. The allowance needed can easily be measured from the amount of spring back shown on the top plate of the bending roll when pressure on the handle is released.

By the simple substitution of a set of phenol fibre blocks for the metal blocks, hot-dipped or tinned spiral electrical cables can also be bent. The coating on the cables does not adhere to the phenol fibre as it would to the original steel blocks.

Small tubing can be bent to any desired angle with this convenient device. In this picture the measuring mark on the movable block indicates a 60-degree bend.



Courtesy, The Linde Air Products Co.

This drawing shows recommended proportions for a small anvil hand cut from scrap rail. The size can be altered to suit individual requirements.

How to Make a Small Anvil

ANY weldor can make a serviceable anvil for the shop from a short piece of scrap rail—he needs only a cutting torch and a steady hand.

The dimensions shown in the drawing give the recommended proportions of an anvil suitable for most light work. This anvil was cut from a 15-in. length of 90-lb rail in about 15 minutes. No grinding or other finishing was necessary. Four holes were drilled in the base to permit the anvil to be attached to a solid support; these holes can be pierced with the cutting flame if no drill is available.

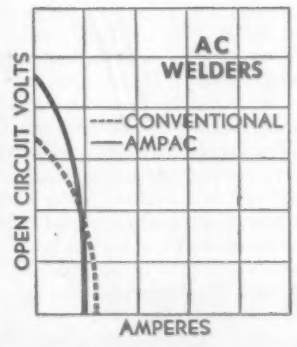
If a conventional rounded horn is required, it can be roughed out with the torch by cutting straight in for a short distance on each side of the rail at the base of the taper and then making the tapering cuts to the points shown in the drawing. The excess metal can be ground off to round out the horn.

AMPAC'S PATENTED CIRCUIT GIVES YOU

Magic Arc Control

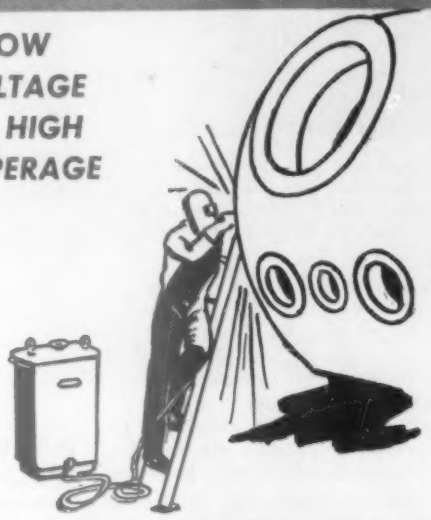
with Correct Striking Voltage Every Time!

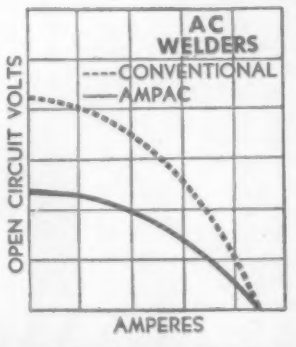
HIGH VOLTAGE AT LOW AMPERAGE



All Welders know that low amperage settings require *higher* arc striking voltage. But Ampac welder's patented circuit steps up this voltage automatically. Conventional transformer type welders have *same* open circuit voltage for both high and low settings.

LOW VOLTAGE AT HIGH AMPERAGE





On high amperage settings Ampac *automatically* cuts down excess arc striking voltage. You get better power factor, lower power costs. And there's no dual control—no changing of taps! Ampac's *magic arc control* gives you *correct* striking voltage every time.

Secret of magic arc control lies in Ampac's patented circuit that automatically provides correct striking voltage for every amperage setting. It's typical of the fine engineering in all Allis-Chalmers welders.
A1937

GET THE COMPLETE AMPAC STORY

Contact our nearby welder dealer or district office for full details on efficient, economical Ampac welders with magic arc control. Also inquire about A-C's complete line of electrodes and welding accessories. ALLIS-CHALMERS, MILWAUKEE 1.

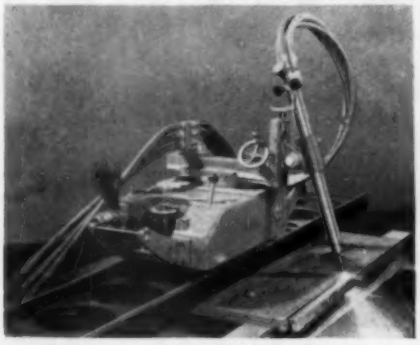
ALLIS AC CHALMERS

HEAR THE BOSTON SYMPHONY: *Every Saturday Evening, American Broadcasting Co.*

New Products to Use

Machine Carriage

★ A heavy-duty straight-line carriage suitable for either submerged-melt welding or flame-cutting has been developed by Linde Air Products. Known as the "Ox-weld-Unionmelt CM-37," the carriage is used with the "CMA-21-B" attachment for plate-edge preparation, single or multiple-torch set-ups or flame-hardening; it is used with the "Oxweld C-45" torch for the cutting of extra-heavy sections.



"Oxweld-Unionmelt CM-37" carriage may be used for either cutting or submerged-melt welding. Here the cutting torch is attached at an angle to bevel plate edges.

The use of high-strength aluminum alloys in construction provides the machine with a high strength-weight ratio. It weighs 87 lb without equipment, can be readily moved from job to job. Overall dimensions are 32 in. long, 12½ in. wide, 9 in. high, plus 2⅛ in. for the forward-reverse lever.

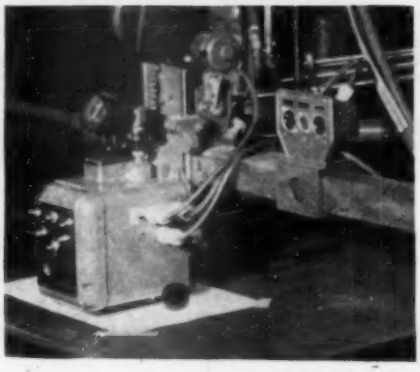
These machines are supplied with speed ranges of 2 to 50 in. per min for general industrial cutting or 7 to 210 in. per min for use with submerged-melt equipment. The standard machine is equipped with a 110-volt a-c unidirectional motor of ¼ hp. Reversing is accomplished mechanically through gears. The CM-37 will operate on track or on a standard 10-in., 25.4-lb I-beam; it can also be operated directly on the steel plate or other flat workpiece. **The Linde Air Products Co.**, 30 East 42nd St., New York City 17.

» «

Electronic-Tracing Head

★ A new electric-eye tracing device for pantograph-type oxy-acetylene cutting machines is known as the "Electronic Bloodhound." This device eliminates metal and wooden templates and all other mechanical or manual auxiliary guiding devices. The most complicated shapes may be cut with great precision from outline drawings or silhouettes, and the electronic-tracing head will faithfully follow the most complex angles and curves.

This electronic-tracing equipment consists of two units—the tracing head and control box. All working parts are fully protected, and the electronic tubes are designed for long life. The tracing head is



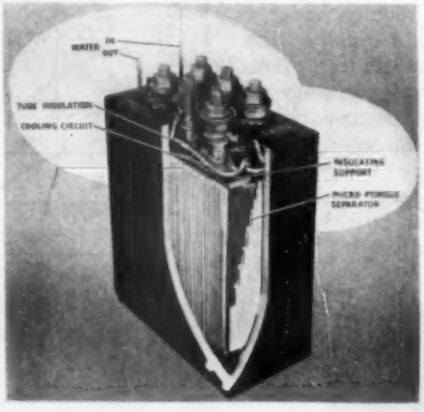
Electronic-tracing head installed on the arm of a multiple-torch cutting machine.

easily attached to any shape-cutting machine in place of conventional tracing equipment. **Air Reduction Sales Co.**, 60 East 42nd St., New York City 17.

» «

R-W Water-Cooled Batteries

★ The Progressive line of battery-powered resistance welders is now available with water-cooled storage batteries developed exclusively for Progressive by the Electric



Maintenance is reduced and welding output increased with new water-cooled storage batteries developed especially for resistance welding.

Storage Battery Co., Philadelphia. The new Exide batteries have an effective capacity several times that of conventional-type storage batteries because of the high charge and discharge rates made permissible by cooling. Other advantages are said to be decreased maintenance, longer battery life, more constant operating temperature, reduction of evaporation, etc.

Cooling of the cells is accomplished by circulating water through some 50 inches of ¼ in. lead tubing in the electrolyte near the top of the cells. (The rate of circulation is determined by requirements of the operation.) The tubing is insulated from the plates by hard-rubber insulators and from contact with the terminals by rubber sleeves. Positioning of the cooling circuit near the upper surface of the electrolyte materially reduces the formation of water vapor and eliminates the excessive loss of electrolyte associated with uncooled batteries, claims manufacturer. **Progressive Welder Co.**, 3050 E. Outer Drive, Detroit.

» «

Steam Cleaning Unit

★ "Oakite-Vapor Cleaning Unit" is a self-contained, oil-fired steam generator that delivers hot vaporized cleaning solutions under pressure to remove grease, grit, grime, paint, etc. A wide range of fuel oils, kerosene or gasoline may be used to operate the unit. The pressures may be selected from a range extending up to 200 psi, permitting use for either light or heavy-duty cleaning. **Oakite Products, Inc.**, 57 Thames St., New York City 6.

» «

Heavy-Duty Metallizing Gun

★ The Metco "Type Y" metallizing gun is the result of an increasing demand for metal-spraying apparatus that can be used for continuous production and heavy-duty metallizing jobs. Its general construction, performance and other features are, therefore, geared for mounted, mechanical operation rather than for hand use.

The new gun is said to double previous spraying speeds. It permits the use of ⅛ in. wire and an acetylene pressure of 15 psi. Gears, worms and bearings are several times larger than any used previously, minimizing wear and replacement. Another improvement is a built-in pump for forced-feed lubrication of all bearings. The gun is non-sensitive to acetylene and oxygen pressure variations of as much as 10 psi. **Metallizing Engineering Co., Inc.**, 28-14 30th St., Long Island City 1, N. Y.

Metco "Type Y" metallizing gun for heavy-duty continuous operation.

"TRANSFAX laid out all these parts on one plate . . . *in only 8 minutes!*"

Let Transfax put your drawings directly on metal, plastics, rubber... along with precise instructions for cutting, drilling, or welding

In operations of from a few to several thousand industrial units, the Kodak TRANSFAX PROCESS wins approval for speeding production . . . makes previously unheard-of savings in time and labor . . .

With line-for-line accuracy, Transfax puts the original drawings from your Engineering Department directly on the metal, plywood, plastics, or rubber . .. ends laborious scribing . . . ends costly, time-consuming errors.

Where layouts and templates are complex . . . where instructions as well as dimensions should be on every piece to be fabricated . . . where accurate lines and points are needed to guide the welder or the man at the drill-press or cutting machine . . . the value of Transfax goes unchallenged. And Transfax withstands rough handling. Even the cutting torch won't erase it except by direct contact.

Transfax is surprisingly simple to install. No special equipment is needed. No special training of workers. In any ordinary room—using a spray gun, a watering hose, and an arc or mercury vapor lamp, Transfax gets big, 8-foot plates ready for fabrication *in 8 minutes!*

For full information on this revolutionary, new Transfax Process, clip and mail the coupon *today*. Now is the time to begin taking advantage of the economies of Transfax.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

TRANSFAX

SAVES TIME • ENDS ERROR
SPEEDS PRODUCTION

FREE FOLDER— CLIP COUPON

Gentlemen: I want to know more about TRANSFAX, its many applications and economies. Please send my copy of the folder to:

NAME_____

STREET_____

CITY_____ ZONE_____ STATE_____

Kodak

AO dust goggles for grinders and chippers.

Dust Goggles

★ Maximum protection against fine dust particles is provided by new AO goggles equipped with acetate eyecups and wire-mesh screens on the inside of each side shield. The eyecups, individually shaped to conform to the contours of the right and left eye, fit snugly against the face to keep out dust and powder, while the fine wire screens hinder the entrance of dust from the side yet allow ventilation. The goggles are equipped with clear "Super Armorplate" lenses. **American Optical Co.**, Southbridge, Mass.

» «

Soft-Soldering Flux

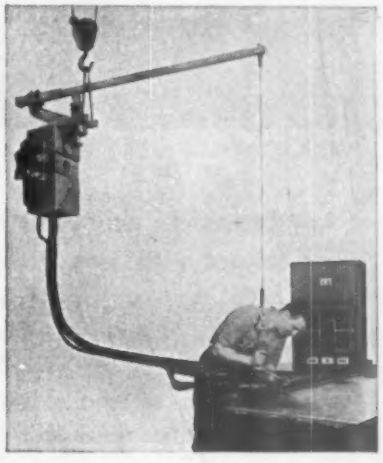
★ A new organic soft-soldering flux, "Superior No. 30," is announced by **Superior Flux Co.**, Public Square Building, Cleveland 13. The composition of this new flux was developed by Battelle Memorial Institute in an investigation sponsored by the Tin Research Institute. Its advantages are activity in effecting the wetting of the surfaces to be joined, and the absence of injurious deposit at the joint. The acid action of the flux is completely neutralized at soldering temperatures, leaving a residue that is normally non-corrosive, non-conductive, non-hygroscopic and easily soluble in water. If the workpiece is well washed with water after soldering, all corrosion-forming residues are completely and permanently removed, claims manufacturer.

This new flux is not offered as a general substitute for the commonly used zinc-chloride fluxes but is recommended particularly for applications where strong acid fluxes cannot be used because of the corrosion factor. It may be used in soldering copper, steel, silver, brass, various alloys, and electroplated parts such as nickel plate, silver plate and cadmium plate.

» «

Spot-Welding Guns

★ A new Sciaky line of overhead portable spot-welding guns includes a variety of standard gun styles in both alligator and "C" types to fit nearly every application. Both pneumatic and hydraulic systems are available with transformer ratings of 50, 75 and 100 kva. Special emphasis is laid on lightness in both gun and cable design in order to permit the operator to work faster with less fatigue. Spring-type or pneumatic balancers are provided for easy positioning.



Sciaky overhead spot welder. One of a new line of welding guns to fit varied applications.

Transformers may be with or without tap switches. Electronic controls are available for control of welding sequence, current interruption and, where desired, welding heat. The unit may be permanently suspended for production lines or hung from any jib hoist, monorail, etc., for tack or structural welding on large assemblies.

The hydraulic units use water with a fast-acting booster and electro-valve. In case of leakage, the hydraulic system is automatically refilled from the same line supplying cooling water to the transformer and gun. **Sciaky Bros.**, 4915 West 67th St., Chicago 38.

Two *Inexpensive* Trucks

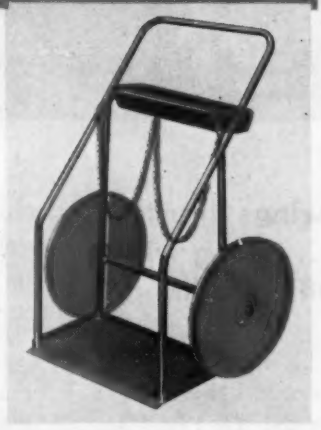
that make difficult welding or carrying jobs

EASIER and SAFER

When loaded, it is a completely portable welding outfit ready for immediate use.

BURDOX DELUXE CYLINDER TRUCK

The finest cylinder truck ever designed. One piece handle provides for single handed operation, solid all steel safety wheels prevent equipment from catching into spokes, beveled reinforced platform makes loading easy—these are three of its exclusive advantages. Costs so little compared with equipment it protects that it quickly pays for itself. Order now for immediate use.



BURDOX NO. 101 UTILITY TRUCK

Makes light of a thousand difficult carrying jobs. All welded tubular construction. Handles straight or curved loads; gas cylinders, boxes, barrels. Mechanical rubber tires and oiless bronze bushings. Easily carried on delivery cars. So inexpensive that every worker with a carrying job deserves to have his own.

So handy that women can use it as easily as men.

Curved to fit single oxygen or acetylene cylinders.

Write for new free HURDOX Catalog of all latest types of welding and cutting equipment.

FOR DESCRIPTIVE LITERATURE AND PRICES, WRITE TODAY TO

THE BURDETT OXYGEN CO.

3302 LAKESIDE AVENUE • CLEVELAND, OHIO

Legging and Spat

The new AO legging is available in specially tanned chrome leather, asbestos or fire-resistant duck.

★ A new legging and spat are scientifically designed to provide leg protection for weldors and foundry workers. Front, back and sides of the leg from instep to knee are protected by the legging, which is available in chrome leather specially tanned to resist heat, or in asbestos or fire-resistant duck. The spat, identical in construction to the legging except for its shorter length, protects the instep and ankle only. **American Optical Co.**, Southbridge, Mass.

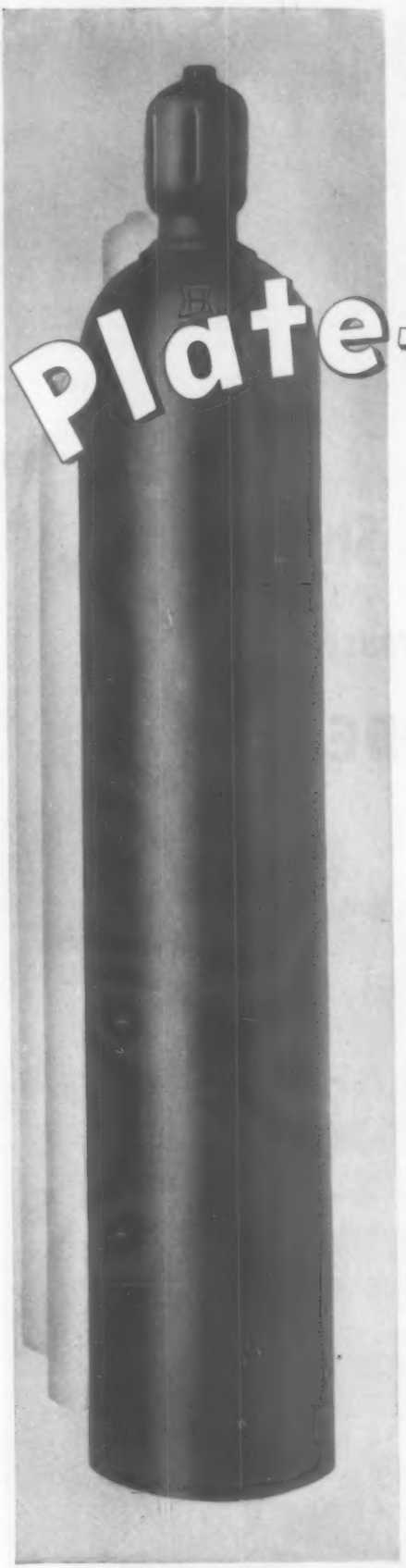
» «

Oxygen Mask

★ The M. S. A. "Chemox" oxygen-breathing apparatus employs a replaceable chemical canister to generate its own oxygen and gives the wearer one hour's protection in

"Chemox" oxygen apparatus is simple to use, can be worn and operated without special training. The replaceable canister does the whole job.

unbreathable air. It weighs 13½ lb complete and requires no cylinders, high-pressure valves or fittings. A unique chemical principle is employed: merely breathing into the canister creates oxygen independently of the outside air. The exhaled breath passes from the facepiece through the exhalation tube and into the canister, where carbon dioxide is removed. The evolved oxygen flows into the breathing bag reservoir, then to the facepiece through the inhalation tube. Before the canister can be exhausted, a preset alarm bell rings a warning to the wearer. **Mine Safety Appliances Co.**, Braddock, Thomas and Meade Sts., Pittsburgh 8.



HARRISBURG CYLINDERS are Plate-made

IN THESE FEW WORDS you get one of the significant reasons why Harrisburg is America's largest producer of seamless steel cylinders. "Plate-made" means maximum uniformity of side walls and bottoms. "Plate-made" means greater uniformity of grain and wall thickness thus assuring absolute protection against thin spots and leaky bottoms. To give the utmost in strength and precision, they are formed from our own special analysis steel and processed by specially designed machinery.

Harrisburg Seamless Steel Cylinders are built with that "extra margin of quality" to give that "extra margin of safety."

●

Send for the NEW

Seamless Steel

CYLINDER

CATALOG

It's New • It's Complete

●

HARRISBURG STEEL CORPORATION

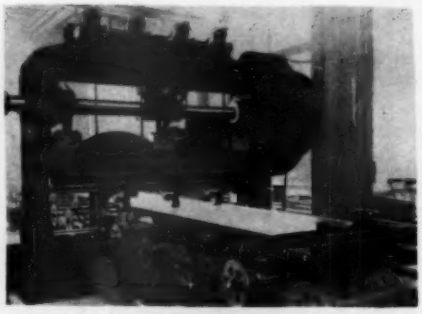
HARRISBURG, PENNSYLVANIA

Harrisburg Makes: Alloy and Carbon Steel; Seamless Steel Cylinders, Liquefiers, Pipe Couplings and Slush Pump Liners; Drop Forgings and Drop-Forged Steel Pipe Flanges; Coils and Bends.

Plate-Edging Machine

★ An entirely new trimmer, the Thomas plate-edging machine, simultaneously trims both side edges of a plate in one pass to prepare it for automatic butt welding. This machine shears the material rather than planes it. The plate is held perfectly flat while under the shear blades so that mill wave (present in the majority of plates) is eliminated when the cut is made. A second advantage is that the plate is carried through the entire shearing cycle in the same relative position; this is accomplished by a combination of stop gauges, extremely rigid holding of the work and accurate guiding methods.

The finished plates are removed from the machine with edges parallel within the extremely close tolerances required for automatic welding. The plate edger may be operated by one man, and a high degree of skill is not necessary. In edging the larger and heavier plates, however, it is economical to utilize a helper for loading and unloading. The machine is manufactured in sizes and capacities to handle any size or thickness of plates used in automatic welding. **Thomas Machine Mfg. Co.**, Pittsburgh 23.



Thomas plate-edging machine. A 3/4 in. plate, 20 ft long, is being prepared for automatic welding.

» «

Goggles, eye glasses and safety shields may be kept from fogging with this new compound for glass and plastic surfaces.

Anti-Fog Compound

★ A new product called "Merix Anti-Fog" is said to prevent fog, mist or steam from forming on any glass or plastic surface. Easily and quickly applied with a soft cloth, it forms an invisible film which is claimed to keep the surface crystal-clear for an indefinite period in any weather or temperature. "Merix" is packed in 4-oz., 8-oz., 32-oz. and gallon bottles. **Merix Photo Co.**, Dept. 144, 712 Wrigley Bldg., Chicago 11.

» «

"Strike-easy" compound aids in establishing and maintaining the arc when using low currents and small electrodes.

Arc-Welding Compound

★ "Strike-easy" is a new arc-welding compound designed to aid in instantaneously creating and maintaining a metal welding arc with low currents and small-diameter electrodes. The compound is an easily applied paste, which can be used on any kind of metal with any type of electrode. It is available (from distributors) in 1-lb. glass jars, ready for use without mixing or other preparation. **General Electric Co.**, Electric Welding Div., Schenectady, N. Y.

EDCO Yellow Shielded

Phosphor Bronze

ELECTRODES

18" length with Center Grip
14" length with End Grip

Edco yellow shielded electrodes have a soft, stable arc, low splatter, sound metal, and can be manipulated readily. The repair and fabrication of vital war equipment with Edco Electrodes have won them high praise from military personnel... Write or wire for your nearest distributor.

SOLE MANUFACTURER

ECCLES & DAVIES
MACHINERY CO., INC.

1910 Santa Fe Avenue • Los Angeles 21, California
DISTRIBUTORS IN ALL PRINCIPAL CITIES

Air* Travels First Class
THROUGH SPIRATUBE

New flexible tubing — non-collapsible, retractable — *moves air, powdered, granular or other light solids anywhere, easier, with minimum resistance to flow because it's uniquely spiral-stitched.

When you need tubing that is non-collapsible and retractable, add this specification — *spiral-stitching* — and make sure of utmost efficiency.

Spiral-stitching provides a smooth channel — no ridges inside to restrict passage, create eddies or collect dirt. It bends around corners with only the slightest reduction of free area.

There is no exposed metal, inside or out. The spring steel helix core is spiral-stitched *into* the fabric and the fabric is covered with tough, durable thermoplastic. Even the couplings are covered. SPIRATUBE is safe where sparking hazard would prohibit use of other tubing.

Check All Non-Collapsible Tubing Against These SPIRATUBE Features:

- No ridges inside tubing
- Bends at any point with only slight reduction in free air area
- Built-in coupling — no fittings needed
- Retracts to about ⅛th extended length
- Far lighter than metal ducts or moulded tubing
- Takes up least space when retracted
- Convenient stowage rack for one-man handling

TROUBLE-FREE VENTILATION

Warner
SPIRATUBE
© REG. U. S. PAT. OFF.
Spiral-Stitched for Strength

SPIRATUBE efficiency was proved in active duty with the U. S. Navy. Available in 3" to 16" diameters and standard lengths up to 25 feet. Send coupon for specification folder. Address The Warner Brothers Company, SPIRATUBE DIVISION, Bridgeport 2, Conn. Branches: New York, Chicago, San Francisco, London.

Mail Coupon Today for more detailed information

The Warner Brothers Company
SPIRATUBE DIVISION
323 Lafayette Street, Bridgeport 2, Conn.

Gentlemen: I'm interested to learn more about SPIRATUBE. Please send specification folder.

Name.....

Company.....

Address.....

Silicone Greases

★ One of the most important technological advances of the war was the development of various silicone products to be used at substantially increased or decreased operating temperatures. The development of silicone insulation, for example, has increased the permissible operating temperature of electrical equipment to 347 F and above. Motors operating at such elevated temperatures require bearing lubricants having greater heat stability than conventional petroleum greases. At the same time, high-altitude flying and arctic operations have necessitated the development of lubricants serviceable at very low temperatures.

To supply the need for high and low temperature lubrication, four new silicone greases have been developed for the lubrication of ball bearings. These new silicone greases are said to be characterized by a high order of heat stability, low volatility, low freezing points and relatively slight changes in consistency over a wide temperature range.

Two of the new greases, DC 31 and DC 41, are compounded of almost entirely inorganic materials. They are black in color due to the use of very finely divided carbon black as a thickening agent. The other two greases, DC 33 and DC 44, are light brown in color. They are compounded with selected metallic soaps and are serviceable at temperatures as high as the melting points of the soaps.

Of these four greases, DC 31 and DC 33 are designed primarily for low-temperature lubrication but also operate efficiently at elevated temperatures. DC 41 and DC 44 are designed for high-temperature lubrication. **Dow Corning Corp.**, P. O. Box 592, Midland, Mich.

» «

Hampton Model "J" a-c welder for small shops, garages, etc.

Miniature Welder

★ A compact, easy-to-handle "miniature" welder is announced by Hampton Electric as Model "J" in its line of welding equipment. This is a small, portable a-c welder for small plants, machine shops, sheet-metal workers, farms, garages, etc. It measures 10 by 14½ in. by 16¼ in. high, weighs 110 lb and has ten welding heats on either 110 or 220 volts.

The Model "J" has no jacks, plugs, magnetic switches or rotating parts. The transformer core is constructed of high-grade silicon steel, impregnated in insulating varnish and baked; the coils are of ample capacity to permit a safety factor on overloads. **Hampton Electric Mfg. Co.**, 12th Street and Pine Place, New Kensington, Pa.

» «

Phosphor-Bronze Electrode

★ A new phosphor-bronze electrode for use in all-position welding of brass, bronze, copper, cast iron and steel has been designated as "Cupro-Arc C." This new product is designed for operation with direct current and reverse polarity. It conforms to AWS-ASTM specification E.Cu-2A and will also meet Navy specification 46-E-5 requirements for Grade II electrodes. Typical applications are the repair and maintenance of bushings, bearing surfaces, castings, gears, propellers and piping; the fabrication of copper-clad metals; the welding of dissimilar metals such as brass to bronze, cast iron to steel, bronze to steel, bronze to cast iron, etc.

"Cupro-Arc C" is said to have a smooth flowing arc which minimizes spatter loss and materially improves deposition efficiency. The deposit is sound and homogeneous, states manufacturer. **Alloy Rods Co., York, Pa.**

New Comparator Gage Saves Time
—Gives 6 Inspections in One!

Even the most inexperienced operator can obtain accurate inspection of externally threaded parts, with the Limitrol Comparator Gage—in many instances, increasing the rate of inspection as much as 400%! The Limitrol, proved in hundreds of war plants, permits 6 visual checks in one: pitch diameter, lead, taper, out-of-roundness, angle, and straightness. Its use reduces inspection and production costs, cuts scrap waste while increasing speeds of operation. If a part passes the Limitrol, it will assemble accurately.

Graduated dials are furnished as standard equipment. These dials are graduated in increments which approximate .0005 inch when the magnification is 250 to 1, and serve as a guide in determining just how far over or under the limits the part might be.

Another "help on the job" is chewing gum. Chewing seems to make work go easier, time go faster. Good chewing gum is available, but there's still a shortage. That's why we at Wrigley wish we could make Wrigley's Spearmint now, to help increase the available supply. You may be sure we will, just as soon as sugar restrictions are lifted. Meanwhile, chew any good available brand, because it's the chewing that really does you good.

You can get complete information from
N. A. Woodworth Co., Sales Division, 1300 E. Nine Mile Rd. Detroit 20, Michigan

Hand Model used for "in process" gaging

AA-51

"Safe-T-Lift" automatic equalizing chain sling (14-ton model) permits the level carrying of an unbalanced 13-ton Diesel motor at the C. B. & Q. railroad repair shop, Burlington, Ia.

Chain Slings

★ "Safe-T-Lift" equalizing chain slings are made in 4-ton, 7-ton, 14-ton, 25-ton and 40-ton capacities and are said to have a safety factor of 4¼ times the design load, according to recent tests of the 7-ton unit. Operation of the sling is extremely simple. The block or chain equalizer unit is placed on the crane hook, and the crane operator spots the hook over the approximate center of gravity of the load. Floormen then attach the sling's chain legs to the load. As the crane hook rises, the sling's chain automatically adjusts itself through the equalizing unit. The latter consists of a steel block and a floating sheave specially constructed to fit the alloy-steel chain. **Hercules Sling Co.**, Rockford, Ill.

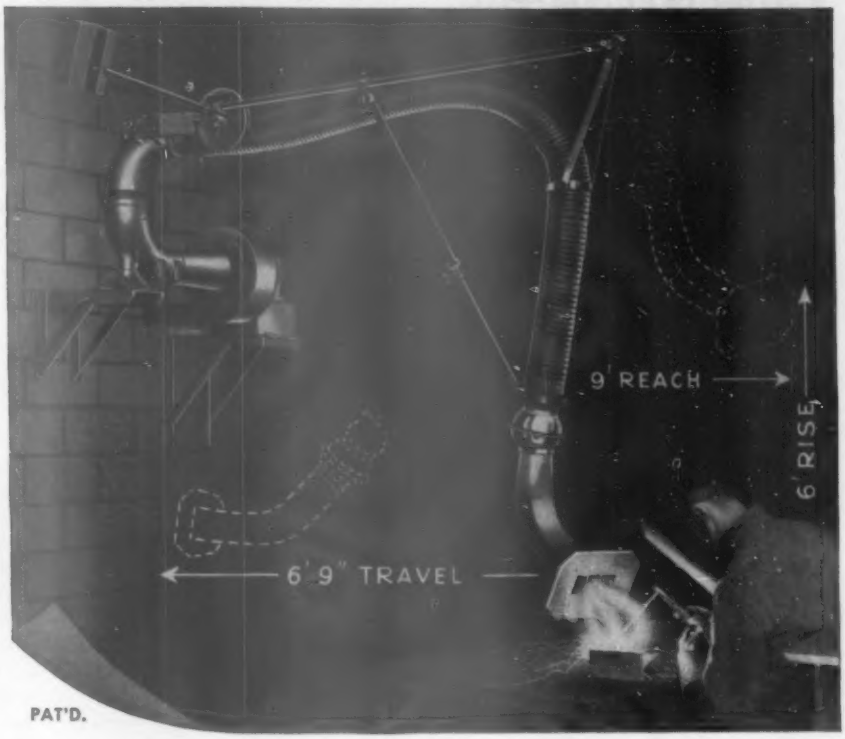
» «

Spatter-Resistant Compounds

★ Two new spatter-resistant compounds, Nos. 9951 and 9952, are furnished in powder form, ready to be mixed with water. The compounds are identical in performance. The only difference between them is that No. 9951 is non-adherent and can be readily removed with an air hose or a dry cloth, while No. 9952 is semi-adherent but can be removed with a damp cloth or a direct stream of water. One gallon of either compound will cover 450 to 750 sq ft of work.

A feature of these compounds is that the surface of the work (even if slightly oily) does not require wetting before they can be applied. Another feature is a special ingredient which eliminates the necessity of a water-soluble binder in order to obtain adhesion. The compounds cannot burn and so are completely smokeless. They are easily mixed and applied. Water is slowly added until a thin paste is obtained, and the mixture can be applied with an ordinary bristle brush. **General Electric Co.**, Electric Welding Div., Schenectady, N. Y.

RUEMELIN Fume Collector



PAT'D.

REMOVES WELDING FUMES

At the Source!

No longer need your employees inhale welding fumes. A Ruemelin Fume Collector solves the problem, quickly and efficiently. It produces a powerful suction that draws out noxious gases, smoke and heat *at the source*. Guards employee health, resulting in less welder fatigue, therefore greater plant output. Has many exclusive features: (1) Clears shop air with minimum loss of building heat. (2) Exhaust snout can be positioned instantly and conveniently. (3) Covers maximum welding territory, vertically, horizontally and by circle swing. (4) Shipped completely assembled, easy to install. Thousands of Ruemelin Fume Collectors now serving war industries. 9 ft. and 15 ft. sizes (radius of swing).

We gladly offer engineering service for your fume collector installation. Write for Bulletin 37-C.

RUEMELIN MFG. CO.

3880 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

MANUFACTURERS AND ENGINEERS

SAND BLAST AND DUST COLLECTING EQUIPMENT, WELDING FUME COLLECTORS

A 4709-⅝-R

★ MAINTENANCE

Salvage by Induction Brazing

A broach 2 by 4 in. in cross-section broke off at the shaft end, close to the cutting teeth. The problem: to make a strong silver-brazed joint without affecting the hardness of the nearby teeth. Here is how it was done.

By **A. E. ERICSON**
Induction Heating Engineer,
Federal Electric Co., Inc.

THE highly concentrated and rapid heat of high-frequency induction heating was recently called upon to salvage a large broach that had broken off at the shaft end. The broach is a unit of about 36 in. long and approximately 2 by 4 in. in cross-section. The break was about 4 in. above the first set of cutting teeth.

Make New Shaft

The tool company that undertook the repair ground a step in the shank of the broach and made a new shaft out of cold-rolled steel for the end that goes into the broaching machine. This shaft was roughed out, and a step was ground in it to match the one previously ground in what remained of the former shaft. The overlap in the step was approximately 2 in.

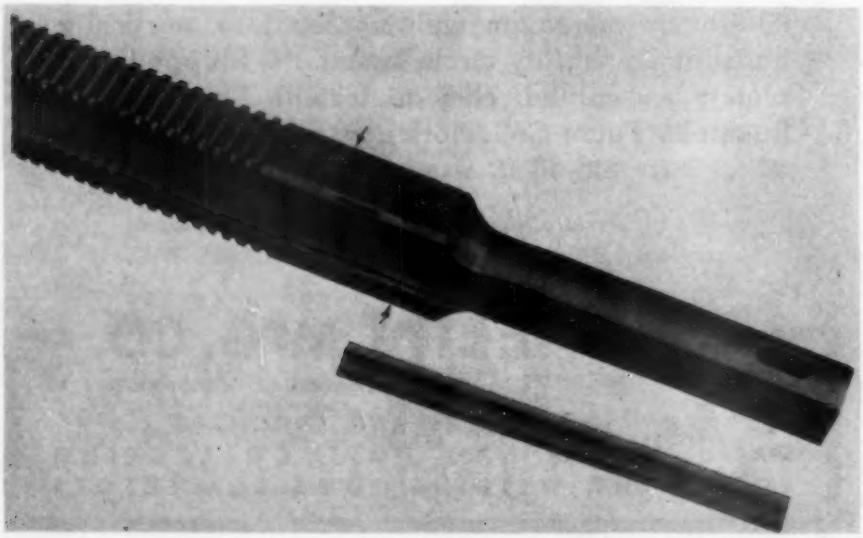
The long lap joint was necessary in order to give the required tensile strength to the joint. It must be remembered that this joint had to stand the full pull on the broach from the broaching machine. The broach itself was made of high-alloy tool steel and was, of course, very hard. To braze such a large joint by means of conventional methods would have been extremely difficult. The heating would be slow—so slow that the hardness of the nearest cutting teeth, which began about 2 in. away from the joint, would have been destroyed. Also, it would have been difficult by conventional methods to get sufficient heat to get a good flow of brazing alloy throughout the entire joint.

In view of the above difficulties, it was decided to apply a highly localized heat by means of a 15 kw high-frequency induction heater. A 0.005 in. sheet of silver-brazing alloy was placed in the joint, and silver soldering flux was liberally applied in and around the joint. A rectangular coil of five turns was then placed around the broach at the joint. Power was sent surging through the coil for 2½ min—a sufficient length of time to raise the joint to a temperature of 1,300 F and cause the silver-brazing alloy to flow freely throughout the entire area.

A 15 kw electronic heater of this type was used to braze the broach. The particular machine shown here, however, is set up with a sink and quench coil for the heat treating of gears.

The joint was quenched slowly by means of compressed air, until it was below 700 F, at which point it was allowed to air cool to room temperature. The necessary machine work was then done, and the broach was resharpened and returned to service.

The broach as repaired by induction silver-brazing. Arrows indicate the break—note the close proximity of the joint to the hardened cutting teeth.



Results

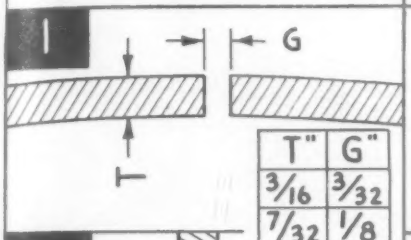
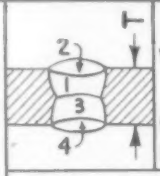
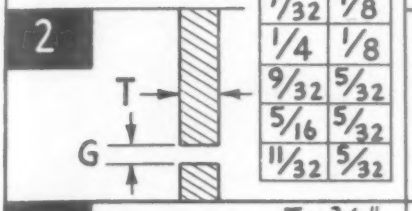
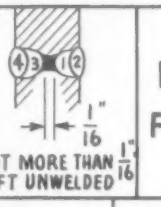
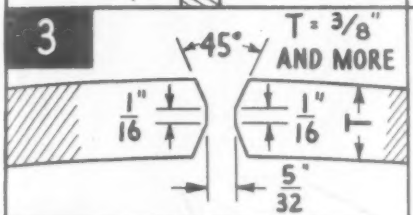
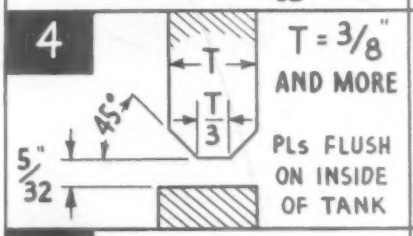
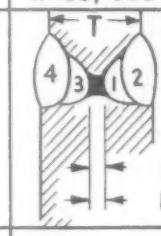
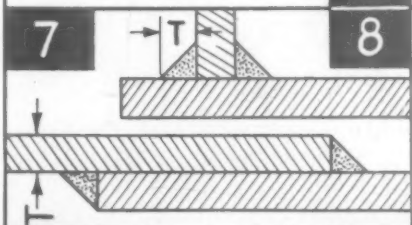
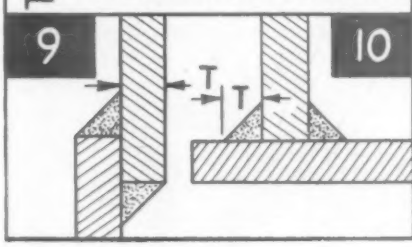
(1) The temperature of the first cutting teeth—2 in. away from the joint—did not exceed 200 F during the time that the high-frequency heat was being applied. Thus the temper of the cutting edges was not disturbed.

(2) A tool that would have cost about $300 to replace was salvaged at a cost of approximately $75.

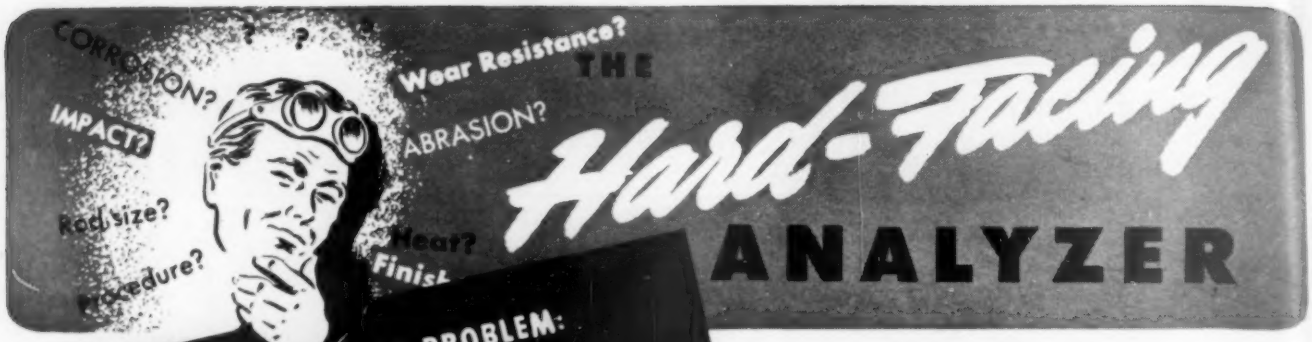
(3) The broach was put back into service in about two weeks' time. A period of 6 to 8 weeks would have been necessary to get a new broach.

A combination of two important factors made this salvage possible. First, is the high-tensile strength of silver-brazing alloys—130,000 psi in a properly made joint. This made it possible to get sufficient strength to withstand the pull of the broaching machine. Second, is the ability of the induction heater to apply high heat rapidly in a restricted area. Taken together, silver brazing and high-frequency induction heating made it possible to obtain a strong joint without affecting the hardness of cutting teeth located only a short distance away.

WELDING INSTRUCTIONS AND JOINT DETAILS FOR CYLINDRICAL TANKS

A.W.S. JOINT DESIGN C.B & I AND A.P.I.	POSITION OF WORK	SIDE OF TANK WELDED FIRST	NO OF PASSES OR LAYERS	DIRECTION OF ELECTRODE TRAVEL	CHIPPING	WELD ROD
1  T" / G": 3/16 – 3/32; 7/32 – 1/8; 1/4 – 1/8; 9/32 – 5/32; 5/16 – 5/32; 11/32 – 5/32	VERTICAL	OUTSIDE		CHIP BETWEEN ① AND ③ WHEN T = 1/4" OR LESS - ALL PASSES DOWNHILL WHEN T IS MORE THAN 1/4" ① SMALL BEAD BACKSTEP UPHILL ② DOWNHILL ③ UPHILL ④ DOWNHILL		FIRST PASS ON ONE SIDE 5/32" ϕ #5 BALANCE 3/16" ϕ V
			USE AS MANY PASSES AS NECESSARY TO OBTAIN FULL BEAD			
2 	GIRTH	INSIDE		BACK-STEP FIRST PASS	WIRE BRUSH	ALL PASSES 3/16" ϕ V
3 	VERTICAL	OUTSIDE		CHIP BETWEEN ① AND ③ ① BACKSTEP DOWNHILL FOR T LESS THAN 1/2" ① BACKSTEP UPHILL FOR T = 1/2" OR MORE ② DOWNHILL ③ UPHILL ④ DOWNHILL ① AND ③ MAY BE MORE THAN ONE PASS IF SO, USE 3/16 ϕ V UPHILL FOR BALANCE		EACH SIDE FIRST PASS 5/32" ϕ #5 BALANCE 3/16" ϕ V
4  T = 3/8" AND MORE PLs FLUSH ON INSIDE OF TANK	GIRTH	INSIDE		BACKSTEP FIRST PASS	WIRE BRUSH	ALL PASSES 3/16" ϕ V
			② AND ④ MAY BE AS MANY PASSES AS NECESSARY			
			NOT MORE THAN 1/16" LEFT UNWELDED FOR T LESS THAN 9/16" NOT MORE THAN (T/3 LESS 1/8) FOR T = 9/16" OR MORE			
5 6	DOWN FLAT		T = 1/8"			5/32" ϕ #5
			T = 3/16" TO 1/4"			7/32" ϕ #5
			T = 5/16" OR MORE			1/4" ϕ #5
	OVERHEAD		T = 1/8"			5/32" ϕ #5
			T = MORE THAN 1/8"			3/16" ϕ V
7  8	VERTICAL CORNER OR LAP		WELD OUTSIDE OF SHELL FIRST	T = 1/4" OR LESS	ALL DOWNHILL	3/16" ϕ V
				T = MORE THAN 1/4"	FIRST PASS UPHILL	3/16" ϕ V
					BALANCE DOWNHILL	3/16" ϕ V
9  10	DOWN GIRTH OR CORNER		T = 1/8"			5/32" ϕ #7
			T = 3/16"			7/32" ϕ #7
			T = 1/4" OR MORE			1/4" ϕ #7
	OVERHEAD		GIRTH AND CORNER - ALL THICKNESSES			3/16" V

Courtesy, Chicago Bridge & Iron Co.



THIS MONTH'S WEAR PROBLEM:

DREDGE CUTTERS

Selecting the proper hard facing alloy for any job must always be based upon operating conditions which vary infinitely between applications. Here are operating conditions imposed upon DREDGE CUTTERS:

SEVERE EROSION of water and silt against cutters.

IMPACT AGAINST submerged debris.

EFFICIENCY of all cutting edges rapidly deteriorates as wear destroys sharpness. Dredge cutters are no exception. Erosion of silt in water, which moves past cutters at high velocity, plus continued collision with gravel and submerged debris, greatly limits useful life of cutters and causes considerable downtime for cutter changes. Furthermore, as cutting edges become dull, their thickness increases with additional loss of digging efficiency.

To increase wear resistance, teeth and blades are now protected with Tube Borium. Not only is 300 to 400 per cent longer dredge cutter life obtained, but cutting edges *are self-sharpening*. Deposits of Tube Borium may be reapplied as required.

Of all hard-facing alloy types, Tube Borium is *first* in wear resistance. Graded particles of tungsten carbide, the hardest and longest wearing of all man-made metals, are encased in mild steel tubes. When applied, the molten tubing forms a solid matrix surrounding each carbide particle and produces an almost abrasion-proof surface. 3/16" Tube Borium is available for either electric arc or oxy-acetylene application. Priced at $3.15 per lb., f.o.b. Whittier, Calif., or distributors' warehouses.

APPLICATION **Electric Tube Borium is applied on leading faces of blades and cutter teeth. Dismantling of the cutter head from the dredge is unnecessary. Inspect periodically and re-hard-face as wear occurs.**

STOODY COMPANY

1141 WEST SLAUSON AVE., WHITTIER, CALIFORNIA

STOODY HARD-FACING ALLOYS

Retard Wear **Save Repair**

News of the Industry

22 Welded Sleeper Trains Ordered by N. Y. Central

Orders amounting to $34,000,000 for 22 sleeping-car trains of new design and 108 baggage-mail cars were placed last month by the New York Central System with the Pullman-Standard Mfg. Co., Edward G. Budd Mfg. Co. and American Car & Foundry Co. These purchases are in addition to a $22,000,000 order for 300 de luxe passenger cars for daytime service placed a few months ago. Altogether, 720 new cars have been ordered by the Central to streamline its service.

Two hundred of the new sleeping cars are to be built by Pullman-Standard, and these units will be of high-tensile low-alloy steel. Edward G. Budd Mfg. Co. will fabricate 112 cars of stainless steel. Welding will be used extensively by both companies. The 108 baggage, mail and railway post-office cars will be built by American Car & Foundry.

The new sleeping cars will be of the all-room type, including single and double bedrooms and de luxe bedroom suites.

» «

Corrosion Engineers Meet in Kansas City, May 7-9

The National Association of Corrosion Engineers will hold its 1946 annual meeting and convention May 7, 8 and 9 in Kansas City, Mo. In addition to the three days' technical sessions, there will be an exhibition of corrosion-resistant, corrosion-mitigation and various types of protective materials. The exhibit will be given in the main area of the Municipal Auditorium and the technical sessions are scheduled for the same building. Convention headquarters will be the President Hotel.

The program as outlined will consist of papers on corrosion practices in representative industries, including power plants, waterworks, transportation companies, buried communication lines, refineries, chemical manufacturing and processing plants and oil pipe lines. Simultaneous sessions are scheduled.

» «

Exhibit Space 98% Sold at Cleveland Metal Show

Manufacturers from all branches of the metal-working industries had reserved 98% of the available floor space at the 27th National Metal Exposition late last month, according to W. H. Eisenman, managing director of the Exposition, and national secretary of the American Society for Metals, sponsor of the event. More than 340 companies will be represented in the exposition, to be held the week of February 4 in Cleveland's Public Auditorium.

"This will be the largest industrial show ever held, exceeding the metal show of a year ago by some 25%," predicted Mr. Eisenman. He estimated that attendance would be in excess of 30,000 industrial executives and engineers.

Thirty-one technical sessions have been scheduled for Monday and Tuesday, February 4 and 5, by the American Society for Metals, with headquarters in the Hotel Statler. A series of four educational lectures will be presented on Thursday and Friday, February 7 and 8. The American Industrial Radium and Radiograph Society will have technical sessions on February 6, 7 and 8 at the Hollenden Hotel. Headquarters for the American Welding Society will be at the Hotel Cleveland.

» «

Welding Used to Make New-Type Gondola Car

A welded alloy-steel gondola car that weighs 6,400 lb less than the average gondola car of plain-carbon steel was on display last month at Chicago's Union station, where it was inspected by over 300 railroad executives. The car is one of 500 being built for the Great Northern Railway by the Pressed Steel Car Co., Pittsburgh. Its advantages, according to F. L. Johnston, vice-president of Pressed Steel, are: greater strength, lighter weight, absence of protrusions to catch loading equipment and the elimination of rivet-joint corrosion.

» «

Utah Firm Opens New Oxygen Plant

Acetylene Co. of Utah has opened a new plant for the manufacture of oxygen at 640 N. Third West St., Salt Lake City 3. This firm also operates a plant for the manufacture of acetylene and carries a complete line of welding equipment and supplies. Don S. Jenkins is general manager.

» «

Students from Foreign Lands Take Lincoln Welding Courses

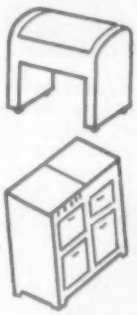
Evidencing the keen interest of foreign lands in American industrial processes, the attendance rosters of welding courses conducted at The Lincoln Electric Company, Cleveland, include representatives from Brazil, Guatemala and Hong Kong. The courses, under the supervision of W. J. Conley, Lincoln welding consultant, include studies in welding fundamentals, analysis of machinery, elements of structural design related to welding, stress distribution, factors affecting cost and production and a review of recent advances in automatic welding.

A welding electrode specially designed for PRODUCTION WELDING!

AGILE Grey WELDING ELECTRODES

Production and sheet metal welding has long felt the need for a welding rod that *will not burn through* and that will have good fluidity. In short it must be a "cold" rod that will not warp the work piece.

Agile Grey Electrode is the answer because it has a coating which embodies Endothermic heat absorbing reaction making it the "coolest" rod on the market. It also has excellent fluidity. This electrode is a "natural" for sheet metal welding. Write for full particulars.



AGILE ACTARC

AMERICAN AGILE CORPORATION
5806 HOUGH AVENUE
CLEVELAND 3, OHIO

Day Long Protection on "Semi-Hazardous" Jobs

• Workers keep the Willson Protecto-Shield* on. Because it combines safety with real comfort and smart appearance. Ideal for light duty jobs. Examples: spot welding, light grinding, wood working.

• Lightweight visor swings up easily when not in use. Held firmly in place by exclusive "Slot-Lock." Both visor and sweatband easily replaceable. Shield is roomy enough to wear over glasses.

• Oversize visor available to guard sides of face and ears from splash and flying particles. Three visor lengths: 4, 6 or 8 inch. Two thicknesses: .030 or .060 inch. Two colors: clear or Willson Tru-Hue green, which prevents color distortion.

For help on eye protection problems get in touch with your Willson distributor or write for information.

REG. U. S. PAT. OFF.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON

PRODUCTS INCORPORATED

Established 1870

227 WASHINGTON STREET • READING, PA., U.S.A.

Making Christmas Cards Is New Use for Welding

The "Merry Christmas" on this card was written with a welding arc and photographed through a welding lens.

The newest and most unexpected use for arc welding was invented by J. R. Morrill of The Lincoln Electric Co., Cleveland. It is—believe it or not—to make Christmas cards.

Mr. Morrill placed a dark welding glass in front of a camera lens, and set the camera for a time exposure. He then wrote the words "Merry Christmas" very rapidly with the welding arc on a 2 by 4 ft steel plate. Because of the dark welding lens, only the powerful light from the arc was recorded on the film. A 1/16 in. electrode of the type used to weld chrome-moly steel was employed with a current of 40 amp to write the letters.

The sketch of the welding operator and the names at the bottom were added to complete the card as shown in the picture.

» «

New Southern Distributor to Handle Welding Supplies

Southern Distributors, Inc., College Park, Ga., has been organized by a group of individuals well known in the welding field for the purpose of distributing Greenleaf products, Monarch steel and a complete line of welding rods, electrodes and accessories throughout the southern states. In addition, Southern Distributors will handle the Greenleaf products in the New York and New Jersey areas. The corporation will also provide welding engineering and consulting services.

John C. Thieme is president of the new concern, and Bent Laune is vice-president and general manager. Mattie Kate S. Thieme is secretary, and Harold A. Snyder is treasurer.

» «

Allegheny Ludlum Steel Buys Arnold Engineering

Allegheny Ludlum Steel Corp., Pittsburgh, has acquired the Arnold Engineering Co., which specializes in "hard" magnetic materials including the Alnico alloys, licensed from General Electric Co.

Allegheny Ludlum has been a leading producer of silicon steels and other "soft" magnetic alloys. The company also produces some of its own hard magnetic alloys and others acquired under license from the Western Electric Co. The consolidated company will produce permanent magnets in every practicable shape and in sizes ranging from a fraction of an ounce to 100 lb.

Peacetime applications of high-strength permanent magnets have been greatly accelerated by widespread wartime experience in their uses. Among ordnance applications were three of the most spectacular projects of the war—radar, the atomic bomb and the proximity fuse.

Robert M. Arnold, president and general manager of the Arnold Engineering Co., will continue in active association with the enterprise.

» «

Aircraft Output Estimated to Fall to 6% of War Peak

Total 1946 aircraft production in America is expected to fall below a billion dollars—or to approximately 6% of the wartime peak annual output of 16 billion dollars—it is estimated by Ernest R. Breech, president of Bendix Aviation. In a recent year-end statement, Mr. Breech declared that this estimated volume of the industry's first peacetime year, while nearly three times the prewar annual volume of $225,000,000 in 1939, will not be sufficient to support the extensive and continuing research program that will be needed to uphold America's supremacy in the air. The necessity for exploring entirely new phases of aerodynamics, together with jet, gas turbine and rocket propulsion and guided missiles, will entail greatly increased financial appropriations for research, he said.

» «

Lamp Research Pays Uranium Dividend

The curiosity of a research scientist, working in the comparative obscurity of a small laboratory at the Westinghouse Lamp Division in Bloomfield, N. J., probably did as much as anything else to make the atomic bomb a reality. For the scientist, Dr. Harvey Rentschler, director of the lamp research laboratories, had been producing pure uranium in small lots for many years before atom-splitting became a national program. In fact, all of the few tiny lumps of pure uranium available in America when the atomic project was started were produced in his little laboratory, which served as the sole source of supply for scientific institutions.

When the all-out atomic bomb program brought an imperative need for a supply of pure uranium, Westinghouse had boosted production to 100 pounds daily—and still this was the only source of the metal. Uranium produced by Westinghouse played the dominant role in the first experimental atomic-power generator, constructed at the University of Chicago and put into operation on December 2, 1942. Of several thousand pounds of the precious metal used in the "pile," all but a few hundred pounds came from the Rentschler-Marden process. It was probably one of the largest dividends ever paid on scientific curiosity.

-and now Meco in 1946!

Despite the fact that we are producing *more* MECO Welding and Cutting Equipment now, than at any other time in our history, we are still unable to keep up with the demand caused by the evident preference 'switch' to equipment bearing the MECO trade mark.

Rigid manufacturing standards do not permit 'rushing through' any MECO product. Precision work and pre-factory testing takes time, but the resultant equipment is worth waiting for.

It has been this policy of exactness that permits us to say . . .

Thirty-five Years Building

BETTER WELDING EQUIPMENT

and the Answers to YOUR Welding Requirements are in this Catalog ➧ ➧ ➧

If you haven't received a copy of our new Catalog No. 120, ask your MECO distributor for one, or write us direct. Literally, an "Encyclopedia of Oxy-Acetylene Welding and Cutting Equipment", it contains detailed illustrations and description of everything used and needed by the welder. Your copy is waiting for you.

MODERN ENGINEERING COMPANY, Inc.

3401-15 PINE BLVD. ST. LOUIS 3, MISSOURI

Tube Turns Expands Production Facilities

Tube Turns, Inc., Louisville, will lease from the Reconstruction Finance Corporation $3,000,000 worth of Defense Plant Corporation equipment which had been installed for war work. The company's board of directors has also authorized the purchasing of additional equipment costing $500,000 to round out production facilities. When the plant expansion is completed, Tube Turns will be $3,500,000 bigger than in prewar years and will have one of the most complete manufacturing establishments of its kind in the United States.

» «

Build Big Furnaces for Stress Relieving

Rust Furnace Co., Pittsburgh, has begun construction of three large industrial furnaces for Chicago Bridge & Iron Co. at Chicago, Greenville, Pa., and Birmingham, Ala. The furnaces at Chicago and Greenville will be used to stress relieve welded pressure vessels. The one at Birmingham will serve primarily to heat heavy plates prior to forming them and for alloy heat treating at high temperatures.

The largest of the three furnaces is being erected at the company's home plant in Chicago. It is 85 ft long, 15 ft 2 in. wide, 16 ft high (from car floor to spring of arch) and has a car width of 11 ft. The stress reliever at Greenville has the same cross-section as the Chicago furnace but is 20 ft shorter. The Birmingham furnace is 42 ft 66 in. long by 17 ft wide by 8 ft 9 in. high.

» «

Brazing Plant Changes Hands

Parts Manufacturing Co., which operates one of the few completely equipped furnace-brazing plants on the west coast, has been purchased by Ellinwood Industries, Los Angeles. This is the third purchase announced by Ray Ellinwood in recent weeks, the others being National Machine Products and California Motor Cultivator Co., Ltd.

Parts Manufacturing will become a division of Ellinwood Industries, carrying on at its present address, 536 Commercial St., Glendale, Calif. The plant has two automatic electric furnaces for brazing and silver soldering.

Present personnel of Parts Manufacturing Co. will not be affected, with the exception of Evan O. Thomas, founder and manager, who is retiring. Ray Maurer will continue as plant superintendent and Collin R. Chambers as sales and engineering service manager.

» «

Centralized Plane Overhauls Planned by Glenn L. Martin

Announcement of a proposed new service to air lines purchasing the Martin Model 202 luxury transports was made recently by The Glenn L. Martin Co., Baltimore. Under this projected service plan, the major overhaul work for all purchasers of the Model 202 would be done at the Martin plant to eliminate the necessity of each air line having extensive ships, parts, supplies and mechanics for heavy work.

The plan would also call for the Martin organization to build several ships and maintain them on a "stand-in" status, to be turned over to the air line on "lend-lease" when a ship is brought in for overhaul. This would eliminate the necessity for the lines to maintain stand-in ships.

» «

Lincoln Electric Celebrates Its Fiftieth Anniversary

To mark the conclusion of their company's first half century in the welding business, employees of The Lincoln Electric Co. last month presented a silver plaque to John Cromwell Lincoln, who founded the business in 1895.

Now chairman of the board while his younger brother J. F. Lincoln serves as president, J. C. Lincoln has seen his firm grow from an initial capital of about $150 to a dominant position in a lusty new industry. Today this arc-welding manufacturer has plants in Canada, England and Australia with branch offices, agents or dealers in all principal cities of the world.

Under the leadership of J. F. Lincoln, the company has been widely commended for its incentive system of worker-management relations.

» «

"JETEC" Will Coördinate Electronics Standardization

"JETEC" (Joint Electron Tube Engineering Council), the newly formed joint agency of the National Electrical Manufacturers Association and the Radio Manufacturers Association, has been making progress in its objective of coördinating all engineering matters related to the standardization of electron tubes. According to Chairman O. W. Pike, the organization of JETEC has been completed with seven committees set up to deal with individual classes of tubes.

10 IMPORTANT QUESTIONS

TO ASK ABOUT THE ARC WELDER YOU'RE GOING TO BUY...

1. Can it deliver from 85 to 95 cents worth of usable welding current out of every dollar's worth of power it consumes?

2. Will it deliver a smooth, stable arc that's easy to handle in *all* positions?

3. Does it eliminate magnetic blow?

4. Does it permit welding at high amperage, without danger of under-cutting or burning through, so as to utilize the maximum rate of deposit for faster welding?

5. Can its current output be adjusted to *any heat* within its range, quickly and simply, without changing any electrical connections?

6. Does it deliver uniformly excellent welding characteristics throughout its entire output range?

7. Is it simply and ruggedly designed, with no moving working parts to wear, or require lubrication and maintenance.

8. Can it be provided with built-in, matched power-factor correction of ample capacity?

9. Does it bear the approval of Underwriter's Laboratories; or does it meet the standards of the National Electrical Manufacturer's Association?

10. Is it a "job-proved" make of welder; that is, does it have a record of years of satisfactory performance in job shops, fabricating plants, shipyards and factories?

●

If it's a G-R welder you're considering, the answer is "YES" right down the line . . . and if you want better, faster welding at lower cost, *don't take "no" for a single answer!*

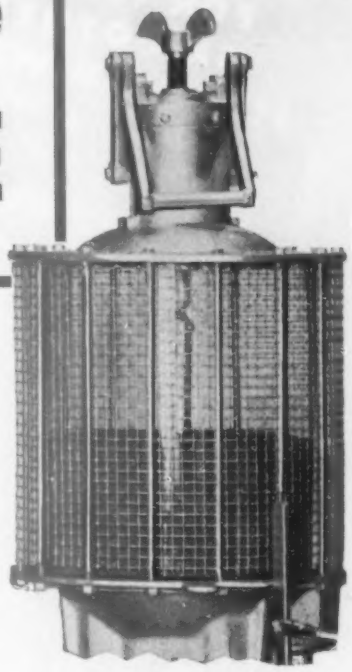
G-R's are built in manual, automatic or combination manual-automatic models with rated capacities of from 75 to 2,500 amperes. There's a G-R to fit your requirements exactly; for the full facts on a.c. welding at its best, see your nearby G-R dealer *now*, or write to:

GLENN-ROBERTS COMPANY

3100 E. TENTH STREET • OAKLAND 1, CALIFORNIA

2107 ADAMS STREET • INDIANAPOLIS 1, INDIANA

Sight Feed is more than a TRADE NAME



● It's true that "Sight Feed" is the name of one of the finest acetylene generators on today's market. But "Sight Feed" is also descriptive of an outstanding feature of this generator: the completely transparent Pyrex hopper which holds the carbide.

A glance at this hopper before you start a welding job will instantly tell you how much acetylene you may expect from your latest "charge." No guesswork—no "running out of heat" in the middle of a job—and the feed is entirely automatic.

"Sight Feed" acetylene is purer, hotter—yet it costs only a *fraction* of what you pay for "bottled" acetylene. Can you afford *not* to buy a "Sight Feed"?

Contact your jobber, or...

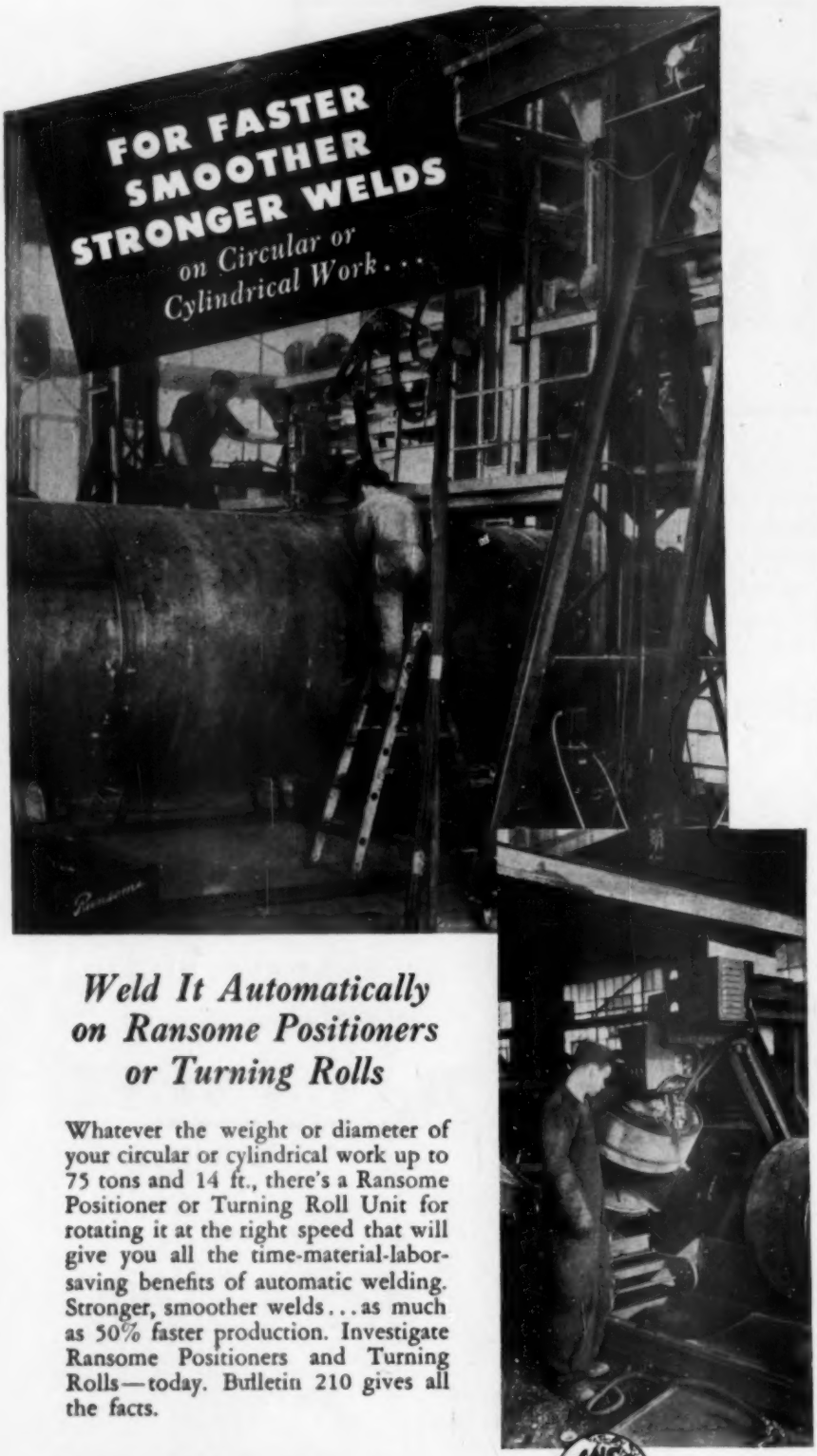
THE SIGHT FEED GENERATOR COMPANY • RICHMOND, INDIANA

For Maneuverability Ya Gotta Have BALANCE!

Columbian Metal Craftsmen, Auburn, N. Y., needed a positioner that would allow many quick changes of position in the welding of their "Featherlite" aluminum furniture. Bentley BALANCED positioning solved the problem.

Operator shifts many-angled work wherever desired, without putting down welding torch or rod. A Bentley "boxes the compass" easily by hand. Model No. 1½-BMO has capacity of 150 lbs. A universal tool . . . for welding, assembly, maintenance and repair shops. Try a Bentley for maneuverability!

Bentley Weldery, Inc. 213 Riegel St. Syracuse, N. Y.



Weld It Automatically on Ransome Positioners or Turning Rolls

Whatever the weight or diameter of your circular or cylindrical work up to 75 tons and 14 ft., there's a Ransome Positioner or Turning Roll Unit for rotating it at the right speed that will give you all the time-material-labor-saving benefits of automatic welding. Stronger, smoother welds . . . as much as 50% faster production. Investigate Ransome Positioners and Turning Rolls—today. Bulletin 210 gives all the facts.

Subsidiary of
WORTHINGTON
Pump and Machinery Corporation

Industrial Division
Ransome
MACHINERY COMPANY
Dunellen, New Jersey

Power Plant Equipment • Turbines & Turbo-Generator Sets • Diesel & Gas Engines • Pumps & Compressors • Air Conditioning & Refrigerating Equipment • Construction & Mining Machinery • Power Transmission Equipment • Locomotive Feedwater Heaters • Welding Positioning Equipment • Liquid Meters

RANS-18

ABOUT PEOPLE

Stanley B. Kirk, president of the Linde Air Products Co., was recently elected a vice-president of the parent company, Union Carbide and Carbon Corp. Likewise elected vice-presidents of Union Carbide and Carbon were: **J. H. Rodger,** president of The Oxweld Railroad Service Co., **A. V. Wilker,** president of National Carbon Co., Inc., **W. J. Priestley,** president of Electro Metallurgical Co., **J. W. McLaughlin,** president of Bakelite Corp., **Dr. J. G. Davidson,** president of Carbide and Carbon Chemicals Corp., **H. E. Thompson,** vice-president of Carbide and Carbon Chemicals Corp., and **R. J. Hoffman,** president of Union Carbide and Carbon Research Laboratories, Inc., **M. G. Dial,** secretary-treasurer of many Union Carbide subsidiaries, was elected secretary-treasurer of the parent company.

» «

William Frederick Durand, professor emeritus of mechanical engineering, Stanford University, was awarded the 1945 ASME Medal, the highest honor bestowed by The American Society of Mechanical Engineers. The award was presented in recognition of Dr. Durand's work in forwarding the design and application of principles of jet propulsion.

» «

The Holly Medal, presented by ASME for "some great and unique act of genius of an engineering nature," was awarded to **Dr. Sanford Alexander Moss,** engineer, General Electric Co., West Lynn, Mass., for his many contributions to the development and application of turbo-superchargers to interna!-combustion engines.

» «

Peter V. Armstrong, well known industrial designer, has been appointed chief of the new consumer goods division of The Federal Machine & Welder Co., Warren, O. It is the purpose of the new division to utilize some of the company's war-developed facilities in the production of consumer goods, the exact nature of which will be announced later. Mr. Armstrong was formerly with H. K. Ferguson Co., Cleveland, as a designer and with the Chase Brass Co. as assistant chief engineer at The Euclid-Chase plant. He was at one time associated with the Henry Kaiser organization.

» «

H. B. Axtell, for some ten years identified with resistance welding in the east, far west and midwest, has teamed with **V. A. Chern** to represent Progressive Welder Co. in the eastern district. The firm of Axtell and Chern has established offices at 15 Gramercy Park S., New York City 3.

EASY-FLO RINGS

"WED" METALS TOGETHER FOR KEEPS

It's the fashion today to join metals with preplaced rings of EASY-FLO silver brazing alloy wire—first, because low-temperature EASY-FLO means fast, reliable, low-cost brazing—second, because preplacing the alloy speeds production, gives accurate control of amount of alloy and assures uniform distribution throughout a joint—and finally, because metals joined by EASY-FLO will never be parted by vibration, shock or extremes of temperature. They're one for keeps. START NOW to get the benefit of EASY-FLO's speed, reliability and economy in your metal joining operations present and future. BULLETIN 12-A tells you how. Write for your copy today.

EASY-FLO fabricated Air Speed Indicator Part. 6 joints in upper assembly brazed simultaneously—then 10 in lower. EASY-FLO rings preplaced at all joints.

STEEL SALES CORPORATION

3348 S. Pulaski Road Chicago Illinois Milwaukee Minneapolis

WAREHOUSES

Chicago, Ill., 3348 S. Pulaski Rd., Phone Crawford 4400
Detroit, Mich., 5151 Wesson Ave., Phone Tyler 6-3000
St. Louis, Mo., 4565 McRee Ave., Phone Grand 5255

DISTRICT OFFICES

FOR HARD-TO-WELD METALS USE

callite PURETUNG electrodes IN THE ATOMIC HYDROGEN OR HELIUM ARC WELDING PROCESS . . .

PURETUNG — 99% PURE TUNGSTEN WELDING ELECTRODES

Callite "Puretung" Electrodes are especially efficient and economical for welding stainless steel, magnesium alloys or in applying tungsten carbide hard facing in tool-making and die changes.

Of 99% pure tungsten, Callite Electrodes resist the extreme heat of the arc in the atomic hydrogen and heliarc processes. "Puretung" Electrodes retain their stiffness, keep the arc properly spaced and are consumed slowly. Deposits are strong, dense, clean and smooth, free from spatter and scale, greatly reducing grinding and finishing.

Look into the advantages of "Puretung" Electrodes for your welding processes. Ask our engineers about specific applications. Callite Tungsten Corporation, 549 Thirty-ninth St., Union City, New Jersey. Branch Offices: Chicago, Cleveland.

STANDARD "PURETUNG" ELECTRODES

Diameter Inches	Length Inches	Current Ranges Amperes
0.040	12	8-25
1/16	12	15-40
5/64	12	20-50
3/32	12	30-60
1/8	12	30-100
5/32	12	70-130
3/16	12	70-150

ALSO SUPPLIED IN RANDOM LENGTHS AND OTHER DIAMETERS TO ORDER

Callite "PURETUNG" ELECTRODES

CALLITE TUNGSTEN CT

Send for Bulletin 154.

PIONEERS IN TUNGSTEN METALLURGY FOR 25 YEARS

Hard-Surfacing with Amsco No. 459 Reduced the Cost of Plow Lathes 76% . . .

An Oklahoma City welding shop received the following letter from a farmer in the Canadian River valley:

"Using an untreated International #0054 plow lathe on an International three bottom plow, I plowed seven acres of gumbo land at a depth of eight inches, after which the lathe was worn out.

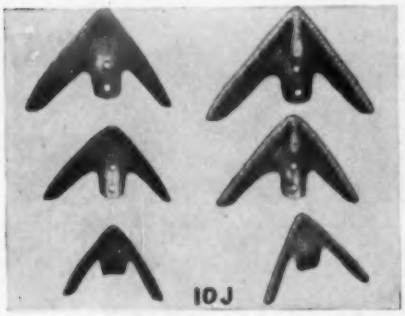
"Using the same type lathe that had been hard-surfaced with Amsco No. 459, I plowed 68 acres. The plow did not pull any harder and the lathe shows only about 15% wear.

"These plow lathes cost $3.00 and the hard-surfacing costs $3.50. For $3.00 I plowed seven acres and the lathe is now completely worn out. For $6.50 I plowed 68 acres and this lathe still has lots of wear in it, proving that it does pay to do hard-surfacing."

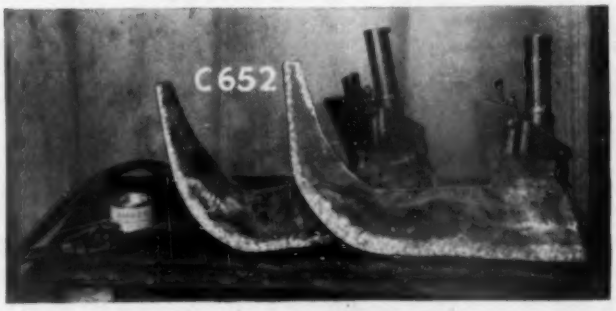
The above figures give a cost for plowing with the untreated lathe of about 43 cents per acre, as compared with 9.5 cents per acre with the hard-surfaced lathe. This shows a saving of 76% in lathe cost effected by the use of Amsco No. 459, but the total saving was much greater, as the hard-surfaced lathe was still good for a lot more service after the test was completed.

Amsco No. 459 is a cast welding rod of high chromium molybdenum and carbon content that provides sound deposits with a hardness of 500-600 Brinell. It effects very substantial savings, as in the above case, when applied to parts subjected to severe abrasion and moderate impact, such as plow shares, dipper teeth, drag chain, rolling mill guides, scraper and shredder knives and other parts exposed to the abrasion of loose materials or friction from contact with other metals.

Send for Bulletin 941-W on Amsco Welding Products.



10-J. Before and after hard-facing cultivator spades with Amsco No. 459. Original spades cultivated 62 acres: hard-faced spades—185 acres.



C-652. These corn planter shoes fabricated by welding were hard-surfaced with Amsco No. 459, increasing service life 41%.

(Amsco Welding Products are produced and sold in Canada by Canadian Ramapo Iron Works, Inc., Niagara Falls, Ontario.)

AMSCO

Foundries at
Chicago Heights, Ill.; New Castle, Del.;
Denver, Colo.; Oakland, Calif.;
Los Angeles, Calif.; St. Louis, Mo.
Offices In Principal Cities

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS • ILLINOIS

AMERICAN Brake Shoe COMPANY

Charles J. Jennings, internationally known arc-welding expert and director of Westinghouse research for the past nine years, has been made engineering manager of the welding department, Westinghouse Electric Corp., East Pittsburgh. **John H. Blankenbuehler,** a design engineer specializing in the design and development of welding apparatus and equipment, has been made manager of arc-welding apparatus, while **E. Hill Turnock, Jr.,** is made manager of arc-welding electrodes. Mr. Turnock, who joined Westinghouse in 1926 as an insulation engineer, was assigned to the development of welding electrodes a decade ago.

» «

Captain Vincent H. Godfrey, who recently completed a tour of service in the U. S. Navy, has returned to Page Steel and Wire Div. of American Chain & Cable Co., Inc. He will serve as sales engineer with headquarters at Monessen, Pa. Captain Godfrey was with Page for two years before he re-entered the Naval service.

» «

Henry E. Guerin, manager of the parent plant of the Douglas Aircraft Co. at Santa Monica, Calif., is retiring January 1 after 25 years with Douglas. He is noted for the invention of the "Guerin process," now in wide use throughout all industry, which employs a thick pad of rubber and a single die to form airplane parts under hydraulic pressure. With this system and three giant presses, Guerin produced as many as 100,000 parts a day at Santa Monica.

» «

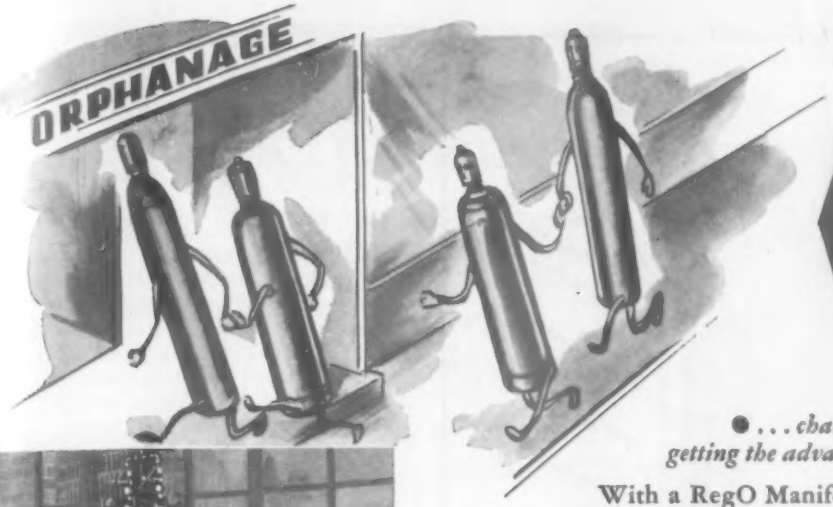
Harry A. Dennis, formerly a welding engineer on clad steels, alloy steels and manual and automatic welding processes for Lukens Steel Co. and subsidiaries, has been appointed Lukens sales representative in Erie, Pa., and vicinity. For the past several years Mr. Dennis has been engaged in welding service engineering work as a member of the Lukens technical sales service.

» «

Richard B. Kropf, metallurgist and formerly district manager of the Copperweld Steel Co., Hartford, Conn., has joined the International Nickel Co., Inc., and will be in charge of the new Cincinnati technical section of the development and research division. The new section will be located at 1715 Carew Tower, Cincinnati 2; it will furnish technical assistance to industry in southwestern Ohio, southern Indiana and Kentucky.

» «

J. L. Singleton, assistant manager of the steam turbine department of the Allis-Chalmers Mfg. Co., has been appointed manager for the 60 district offices of the company's general machinery division's sales department. Mr. Singleton has been with Allis-Chalmers since 1926.



Are YOUR CYLINDERS ORPHANS?

● *. . . chances are that they are if your shop isn't getting the advantages of modern manifolding methods!*

With a RegO Manifold, designed for your exact requirements, you'll eliminate costly cylinder changes in the middle of jobs . . . reduce hazards and trouble caused by wheeling cylinders throughout your shop . . . and save gas as a result of uniform emptying of *all* cylinders.

Learn *now* how a RegO Manifold can reduce your shop overhead —there's no obligation.

REGO

The BASTIAN-BLESSING Company

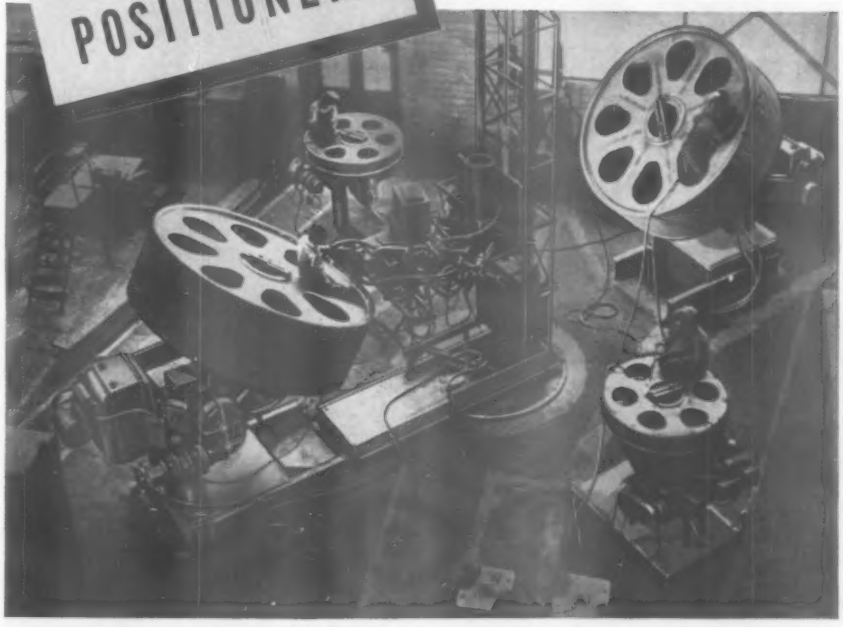
4239 Peterson Ave. Chicago 30, Ill.

Pioneers and Leaders in Equipment for Using and Controlling High Pressure Gases

---

C-F POSITIONERS

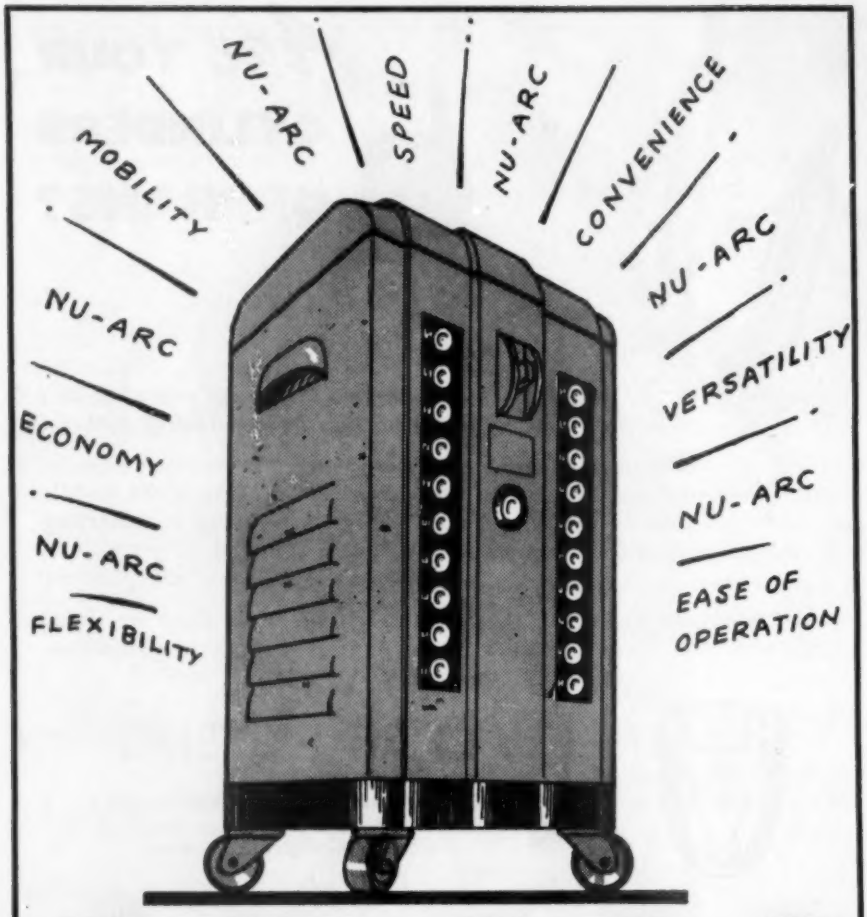
. . . permit progressive automatic and hand welding



A "double production line"—in a 30 ft. square space handles all of the progressive steps of building up 2 sizes of large turbine gears simultaneously.

Four C-F Positioners are grouped radially around one automatic welding machine—2 No. 12s (1,200 lb. capacity) in diagonally opposite corners, 2 No. 140s (14,000 lb. capacity) in the other corners. With this arrangement, the single automatic welding machine can serve all 4 positioners and is used for all peripheral welds on the weldments. For this operation, the positioner rotates the tilted weldment under the electrode at any desired speed from 0 r.p.m. up. While the automatic welding machine is busy on one weldment, 3 welders are completing the hand welding operations on the other 3 C-F Positioners, which under push button control, turn and tilt weldment to any desired position permitting all welds to be easily made "down hand."

CULLEN-FRIESTEDT CO. 1309 S. KILBOURN AVE. CHICAGO 23, ILL.



NU-ARC

A-C WELDING AT ITS BEST!

AN A-C WELDER THAT TAKES LIGHT AND HEAVY WORK IN ITS STRIDE! A STURDY, COMPACT MACHINE TO MEET ALL YOUR WELDING REQUIREMENTS WITH THE TYPE OF PERFORMANCE THAT ONLY A-C WELDING CAN GIVE.

NU-ARC FEATURES

All power is converted into welding current. PAY ONLY FOR THE POWER YOU USE!

NU-ARC is a packaged unit that comes complete with welding accessories, ready to use. Simply connect to power supply — and you're ready to weld.

Easy to use. Desired current range to fit the job is quickly selected by inserting plug-in taps.

Always ready. Mounted on casters for easy mobility. Compact in size, but large in output. Has the stamina needed for production work as well as for job welding in shops, garages and farms.

300 and 400 amp. models have special pipe-thawing attachments.

Five sizes, from 150 to 450 amps. maximum, in standard current range steps. Operates on A-C only, voltages 220-440; 50 or 60 cycles.

Send for illustrated circular and price list.

ELECTRIC ARC, Inc.

152-158 Jelliff Ave. **Newark 8, New Jersey**

Edgar Kaiser, oldest son of Henry J. Kaiser, has been elected a member and vice-chairman of the board of Kaiser-Frazer Corp., Willow Run, Mich. During the war, Edgar Kaiser directed the building of the three Kaiser shipyards at Portland, Ore.

» «

H. Norman Miller, a member of the industrial sales staff of the Westinghouse Electric Corp. at Portland, Ore., has been named manager in the Portland area. He will succeed **L. G. Fear,** who will act as the company's special representative in the Seattle and Portland areas.

» «

William H. Knight has resigned as manager of the Duluth branch sales office of Allis-Chalmers. He will be succeeded as manager at Duluth by **John G. Barta** of the Milwaukee district office.

» «

George W. Lonergan, president of the H. V. Walker Co., Elizabeth, N. J., has been elected treasurer of the National Magnesium Corp., Elkton, Md.

» «

Charles G. Curtin, employee in the purchasing department of Carnegie-Illinois Steel Corp., Chicago, has been awarded the company's Judge Gary Service Medal. Mr. Curtin, who retires on January 1, has had more than 52 years of uninterrupted association with United States Steel Corp. subsidiaries and predecessor companies.

» «

G. O. Britton has been appointed director of sales of the farm equipment division of Graham-Paige Motors Corp., Willow Run, Mich. Mr. Britton has supervised development of the farm equipment division during the year he has been with the automotive company. He has had 12 years of experience in the farm equipment business, starting as district manager for Allis-Chalmers in 1934.

» «

H. M. Munson, formerly with Manning, Maxwell and Moore, has joined Claud S. Gordon Co., Chicago, as manager of the newly organized industrial instruments division.

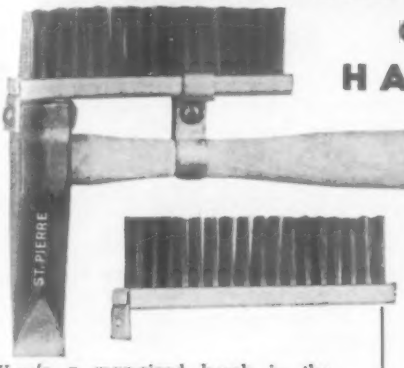
» «

Emil A. Imbembo, senior metallurgist at the New York navy yard in the metallurgical division of the materials laboratory, has been appointed adjunct professor of metallurgy of the Polytechnic Institute of Brooklyn.

» «

Adrian L. Potter, formerly executive secretary of the American Society of Tool Engineers, Detroit, has been appointed staff head of the New England division of the National Patent Council. His new headquarters are in Boston.

ABUSE MEANS NOTHING TO ST. PIERRE CHIPPING HAMMERS



Here's a man-sized brush in the right position for easy use after chipping scale from welded surface. Hammer-Chisel made of highest quality tool steel. Entire tool is well-balanced. For economy, for durability use ST. PIERRE Hammers.

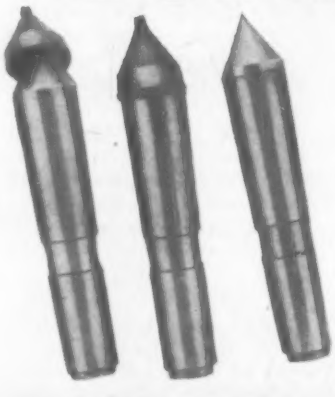
Breaks the Scale Cleans the Surface in One Operation

Order Today From Your Jobber or Direct

ST. PIERRE Chain Corporation

WORCESTER DROP FORGINGS MASSACHUSETTS

YOUR WORN TOOL STEEL CENTERS *Can be Salvaged by using* COLMONOY



TIPPING SERVICE

● New tip castings of Colmonoy No. 6 can now be applied to your centers by using Silver Solder or a low temperature brazing alloy. Will outlast and outwear new, untipped centers.

We will apply for you, or furnish tips only. Moderate prices. Write for Bulletin CT-1 for complete information.

WALL-COLMONOY CORP.

720 Fisher Bldg. Detroit 2, Mich.

WELD *Continuously*

TO WELD PROFITABLY

"Standard" Welding Positioner makes welding easier and faster — it eliminates the costly "pause" . . . no need to interrupt production to position or chase the work. Table speeds adjustable from 1" to 180" per minute in either direction for work weighing up to 700 lbs.

Rotation of table instantly started, stopped and reversed by foot control — and hydraulically power tilted through 135° from horizontal by easy manual lever control.

Height of table quickly adjusted between 30" and 36".

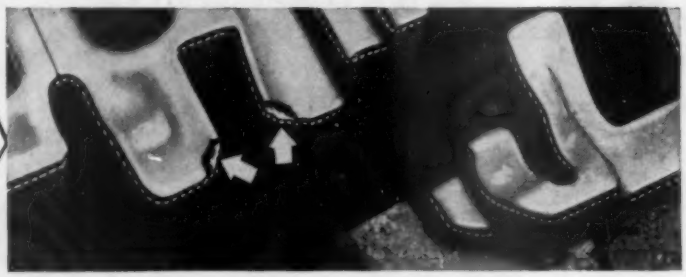
Write for Catalog

STANDARD MACHINERY CO.

1473 Elmwood Ave., Providence 7, R. I.

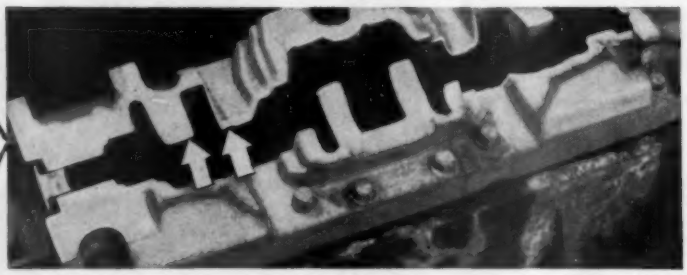
Quickly repair damaged dies ... by WELDING

HOW TIME IS SAVED



You realize huge savings when you repair damaged dies by welding because you *confine actual repairs to the immediate faulty areas only.* Dotted line in the illustration above indicates the ordinary time-consuming method of repair which necessitates reworking the entire area. You can repair virtually all types of tool steel by using the proper Eureka Tool Steel Welding Electrode. You can salvage or reclaim die units used for blanking, forming, forging, drawing, embossing, etc., etc.

NO HEAT TREATING

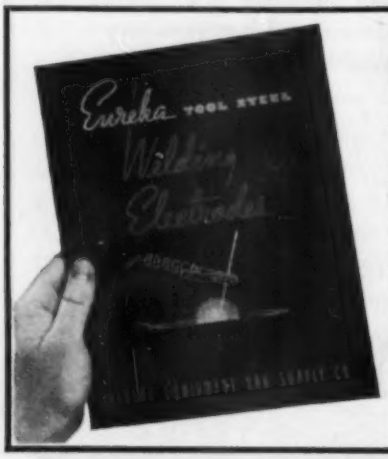


Weld deposits of Eureka Tool Steel Electrodes are, in most cases, "hard-as-welded," and subsequent heat treatment, other than tempering, is not necessary if the units lend themselves to grinding. Metallic arc welding with Eureka Tool Steel Electrodes retains dimensions within close limits. WRITE today *for your free copy of our 40-page Tool Steel Welding Manual, which graphically illustrates how welding can save you valuable man hours through repairing dies, composite fabricating, correcting design or rectifying errors.*

Eureka Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

223 LEIB STREET • FITZROY 3715 • DETROIT 7, MICHIGAN



FREE *Just clip and mail the coupon below for your free copy of our latest 40-page illustrated booklet, which will help you save many valuable man hours and minimize production delays.*

WELDING EQUIPMENT & SUPPLY CO.
223 LEIB ST.
DETROIT 7, MICHIGAN
Rush me your catalog:

NAME_____

TITLE_____

ADDRESS_____

CITY_____ STATE_____

Joseph B. Terbell, affiliated with various divisions of American Brake Shoe Co. since 1928, has been appointed executive vice-president of Brake Shoe's American Manganese Steel Division. In 1940 he was promoted from a district sales manager's position to a vice-presidency with American Manganese. Three years later he was named first vice-president.

» «

J. K. Keogh, field engineer, has been appointed manager of the Pittsburgh district office of the Allis-Chalmers Mfg. Co. Mr. Keogh has been with the Allis-Chalmers Pittsburgh office since 1919.

» «

Paul H. Merriman, for eight years head of the electrical group, tool engineering, of The Glenn L. Martin Co., Baltimore, has assumed new duties as head of the electrical and electronics section of the laboratories of the Martin organization.

» «

James K. Sutherland, for 32 years with the Youngstown Sheet and Tube Co., has been named superintendent of the Ford Motor Company's rolling mills and open hearth in the Rouge plant.

» «

Max J. Pischke, formerly Pittsburgh district sales manager, has been promoted to the position of manager of warehouse sales, Allegheny Ludlum Steel Corp., Pittsburgh.

» «

Chester V. Nass, manager of the foundry division of Pettibone Mulliken Corp., Chicago, has been elected vice-president of this company.

» «

Frank W. Jones, former Navy Lieutenant Commander, has been named to head the light metal products division of Northrop Aircraft, Inc., Hawthorne, Calif. Commander Jones served with Air Group 20 on the carriers *Enterprise* and *Lexington.*

» «

Robert M. Hatfield has resigned as deputy vice-chairman of the War Production Board to become assistant general sales manager of Combustion Engineering Co.

» «

Robert H. Wendt has opened an office for the practice of patent and copyright law at Six North Michigan Ave., Chicago 2.

» «

C. N. Schmidt, advertising production supervisor, has been appointed advertising manager of the American Steel & Wire Co., Cleveland. **Wilmer H. Cordes** will devote his full attention to the responsibilities of sales research, development and promotion, relinquishing the position which Mr. Schmidt now assumes.

Filter Lens—for helmets and shields.
Cover Lens—for cup type goggles.

Are you paying too much for lenses?

• Spending more for lenses than you need to is like throwing money away. Save it, by ordering Amcoweld Protective Lenses that are not only reasonable in cost but also "tops" in quality and service life. All shades—all types (flat, clear and coated) for welders helmets, hand shields, goggles, and spectacles. Prompt delivery. Write for fully descriptive literature and prices.

EASTERN EQUIPMENT COMPANY, Inc.

Industrial Safety Division • Willow Grove, Penna.

MANUFACTURERS OF AMCOWELD PRODUCTS

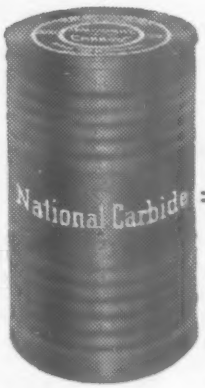
GET THE FACTS ON ALUMINUM BRAZING

Nothing tricky about Aluminum when you use the KRE-CO ALUMINUM BRAZING PROCESS. Our simple yet effective method is being used successfully — saving time and money — doing a better job of bonding. Bulletin J4 gives the facts. Yours upon request — it belongs in your files.

KRE-CO MULTICHEMIC FLUX
DIVISION OF
CHARLES W. KRIEG CO.
52-60 Dickerson St. Newark 4, N.J.

National
Carbide

•
EFFICIENT
ECONOMICAL
DEPENDABLE
•



For
Welding and Cutting
Specify

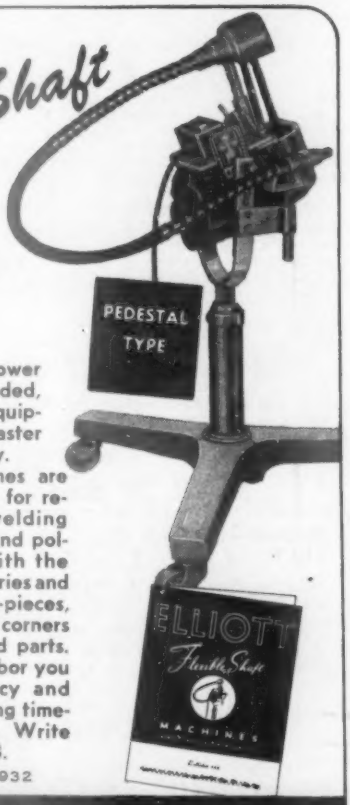
NATIONAL CARBIDE IN THE RED DRUM

Write us for information as to nearest available stock.

NATIONAL CARBIDE CORPORATION

60 E. 42nd St., New York 17, N. Y.

ELLIOTT *Flexible Shaft* MACHINES



Wherever constant power in a portable tool is needed, Elliott Flexible Shaft equipment will do it better, faster and more economically. These rugged machines are particularly adaptable for removing flash after welding and for the grinding and polishing of welds. With the wide variety of accessories and interchangeable hand-pieces, it is possible to work in corners and irregularly shaped parts. Even with unskilled labor you can maintain efficiency and economy by eliminating time-consuming hand work. Write today for Bulletin 44B.

ESTABLISHED 1932

ELLIOTT MANUFACTURING COMPANY
215 PROSPECT AVE. BINGHAMTON, N.Y.

For more efficient, economical, profitable

arc-welded production

You can get the back-ground, the technical know-how you need to analyze any arc-welding problem on the basis of its means of control—all readily available in this new book!

Just Published!

Arc Welding Engineering and Production Control

By Walter J. Brooking
Director of Testing and Research,
R. G. Le Tourneau, Inc.
347 pages, 5½ x 8, 227 illustrations, $4.00

MAKE this technical know-how yours. Get the facts on arc welding as a major production method. Know the problems to expect, and the solutions to meet them, in arc-welding production and control. Here at your fingertips is a wealth of information on arc-welding specifications, material control and arc-welding costs, jigs and fixtures for arc-welded mass production, the inspection, machining of arc-welded products, the training of arc-welding operators, and a great deal of other valuable data so often learned expensively by experience alone.

Helpful answers to these questions

How do I analyze the cost of flame cutting technique for best economy?
What is the cost of poor fit-up and over-welding, and how can it be avoided?
When is it best to use direct-current welding and when alternating current?
What is the value of electrode comparison tests?
How can I keep up to date on welding?

Look at this partial list of contents:

What Arc-Welding Specifications Should Show
Material Control and Arc-Welding Costs
Control of Flame Cutting of Parts for Arc Welding
Jigs and Fixtures for Arc-Welded Mass Production
Inspection of Mass-Production Arc-Welded Products
The Machining of Arc-Welded Products
Cleaning of Arc-Welded Machinery Prior to Painting
Arc-Welded Shop Fixtures and Accessory Production Equipment
Direct Current and Flexibility of Welding Operations
Mass Production with Alternating-Current Welding
Arc Welding and Its Use by Equipment Servicemen

See it 10 days!

McGraw-Hill Book Co.,
330 W. 42 St., N. Y. C. 18

Send me Brooking's Arc Welding Engineering and Production Control for 10 days' examination on approval. In 10 days I will send $4.00, plus few cents postage, or return the book postpaid. (Postage paid on cash orders.)

Name .....
Address .....
City and State .....
Company .....
Position .....

In Canada: Mail to Embassy Book Co., 12 Richmond St. E., Toronto, 1

WE 1-46

Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Electrode Chart

This large 17 by 25½ in. reference chart gives the chemical and physical properties of all Page welding electrodes and gas welding rods. Much welding data are condensed and arranged for easy finding. The chart is designed to hang on the wall but may be folded and filed in a desk drawer. When writing for it, please refer to Wall Chart DH-1314. **Page Steel & Wire Div., American Chain & Cable Co., Inc.**, Bridgeport 2, Conn.

» «

NEMA Arc-Welding Standards

A complete set of new standards for electric arc welders and electrodes, Publication No. 45-105, has been released by the National Electrical Manufacturers Association. These welding standards completely cover d-c welders of both variable-voltage and constant-potential types, including circuit control equipment for the latter. Also included are two types of a-c transformer-type arc welders designated as the industrial type, single operator, and the limited-input type.

The new standards coördinate and simplify the method of rating welders without basically changing the size of the welder. For example, the d-c 300-amp welder with a specified maximum and minimum output as covered by the revised standards does not basically differ in actual welding capacity from a d-c 300-amp welder meeting the requirements of the superseded standards.

Heretofore, d-c welders were rated on a short-time basis, and a-c welders (except large machines used in automatic welding) were rated on a duty-cycle basis, each with a maximum and minimum welding current. The new standard, using the d-c welders as a base, rates both d-c and a-c welders on the basis of the same duty cycles. In addition, a definite duty cycle has been assigned to the maximum output.

A new standard for transformer-type arc welders below 200 amp is introduced for the first time. These welders are designated as limited-input type, transformer arc welders. This new standard is developed to apply to welders served by single-phase power lines of limited capacity supplying farms or small communities.

The electrode standards have been revised and published in two parts. The part covering classifications, standard diameters and package weights is included in the present publication. The new standard for color markings for electrode identification is published as a separate standard, Publication No. 45-108.

The new set of standards represents an important contribution in promoting economies and assisting users in the proper selection of arc-welding machines. Copies may be obtained from the **National Electrical Manufacturers Association,** 155 East 44th St., New York City 17.

» «

Wall Chart on Alloy Welding

A 20 by 30 in. reference chart for wall mounting presents much useful data in tabular form on high-alloy and low-alloy electrodes. There are eight tables. Table I gives chemical analyses of weld-metal deposits. Table II gives corrosion-resistance data of electrodes in six general classifications: austenitic chromium-nickel, austenitic molybdenum bearing, austenitic columbium bearing, austenitic heat-resisting, martensitic chromium-molybdenum, and ferritic straight-chromium. Table III covers ferritic electrodes for special purposes and Table IV alloy electrodes for surfacing. The four remaining tables deal wth heat treatments, electrode identifications, welding current and arc voltages, electrode lengths for various diameters. A copy of this handy chart will be sent upon request to **Arcos Corp.,** 1515 Locust St., Philadelphia 2.

» «

Arc Welder Booklet

Wilson "Bumblebee" a-c transformer-type welders are the subject of a recent 16-page, letterhead-size booklet. Among the welders described are the 300-amp and 500-amp standard and all-weather models and the new 200-amp model designed to meet the demands for a small arc welder. Additional sections are devoted to running gear, remote control and the Airco line of coated electrodes for a-c welding. Precisely labeled drawings and many photographic reproductions supplement the text. **Air Reduction Sales Co., Inc.,** 60 East 42nd St., New York City 17.

» «

Magnifier Folder

A 3½ by 6¼ in. folder describes the use of "Super Sight" magnifying lights for industrial or laboratory first-aid purposes. **The Boyer-Campbell Co.,** Safety Div., 6540 St. Antoine, Detroit 2.

Fuse-Well
Cast
Welding Rods

The Standard of
QUALITY
THROUGHOUT THE WORLD

Cast Aluminum Welding Rods
of Standard Analysis

Plain and alloyed Gray Iron
Welding Rods and Electrodes

THE CHICAGO HARDWARE FOUNDRY CO.
Dependable Since 1897
146 ENGINEERING BUILDING
NORTH CHICAGO, ILLINOIS

"FLUXINE" Fluxes are the result of fifty years of scientific research into the metal-joining field. There are 89 FLUXINE Fluxes . . . one for every welding, silver soldering, brazing, and soft soldering operation . . . each with its own properties, designed for a particular metal-joining operation. All have been perfected not only for highest efficiency, speed, and long life, but for economy and safety as well. FLUXINE Fluxes cause no injurious fumes to irritate eyes or nose of the operator.

So confident are we that wherever a metal-joining operation is required FLUXINE Fluxes will do it better, faster, and more economically than any competitive fluxes, that we will be glad to have you try it at our expense.

Write today for a generous sample and directions for using FLUXINE Fluxes on 57 different metals.

Ask your jobber . . . he knows the FLUXINE line produces the best results with the greatest economy.

KREMBS & COMPANY
Est. 1875
Dept. G, 669 W. Ohio St. • Chicago 10, Ill.

FLUXINE
TRADE MARK REGISTERED U S PAT OFF

Mid-States METAL ZIPPER
THE WORLD'S BEST
ARC WELDER

AUTOMATIC ARC
WELDS THIN METALS
BEGINNERS CAN USE IT EXPERTLY.. QUICKLY

. . . . . AND MANY OTHER FEATURES
NOT FOUND IN ANY OTHER TYPE OF WELDER
Sold by Leading Jobbers Everywhere
WRITE FOR NEW FREE BULLETIN JUST OFF THE PRESS
Mid-States EQUIPMENT CORP.
2431 South Michigan Avenue Chicago 16, Illinois

GIRL OPERATOR Makes INTRICATE WELD SET-UP

Duplicate fixtures permit girl operator to make intricate set-up while welder tack welds assembly previously set up. All parts held firmly in accurate position with De-Sta-Co 110-C Clamps.

4 DE-STA-CO 110-C TOGGLE CLAMPS

enable a girl operator to quickly and accurately form an intricate set-up, held in secure position for the succeeding welding operation.

So many production and assembly operations are simplified by De-Sta-Co Toggle Clamps. And there are so many types and sizes that every purpose can be served.

Send for Catalog No. 45.

DETROIT STAMPING CO.
Established 30 Years
334 Midland Ave • Detroit 3, Mich.

"Ampco-Trode" Application Chart

Bulletin W-8, "Ampco-Trode Industrial Application Chart," is a ten-page, letterhead-size bulletin listing industries in which coated aluminum-bronze electrodes have been used, types of applications in these fields and recommended electrode grades for each job. Between 30 and 40 industries are lisfed vertically, and approximately 150 applications ranging from arbor shoes to wire guides are listed horizontally across the page. The bronze electrode recommended for a particular application will be found at the junction of the proper horizontal row and vertical column. This chart is based on actual case histories reported by the company's welding engineers; thousands of case histories are said to have been studied in compiling the data presented. **Ampco-Metal, Inc.,** 1745 S. Thirty-Eighth St., Milwaukee 4.

» «

Metallizing Booklet

Chief features of the new "Type Y" metallizing gun are described in Metco Bulletin 49. This gun was designed, engineered and built exclusively for heavy-duty continuous production; the text and sketches tell just how its construction differs from that of the usual hand gun for metallizing. Several detailed photographs are reproduced page-size in two colors to indicate the bronze and the aluminum parts of this equipment. Tables of spraying speeds and oxygen and acetylene consumptions per lb sprayed for various metal are also included in the 16-page, 11 by 8½ in. booklet. **Metallizing Engineering Co., Inc.,** 38-14 30th St., Long Island City 1, N. Y.

» «

Welding Guide

A new 8½ by 11 in., 8-page booklet, "Guide to Everyday Welding," is offered as a guide to the selection of the proper types of electrodes or welding wire to use for welding various types of materials, structures and equipment. The information is arranged in easy-to-find tabular form, indexed by industries. Included is a condensed chart which gives the physical properties, recommended current settings and analyses of weld-metal deposits for stainless-steel, carbon-steel, shielded-arc, bare and subcoated electrodes and welding wires. **Page Steel & Wire Div., American Chain & Cable Co., Inc.,** Monessen, Pa.

» «

Electrode Catalog

"Arc-Welding Electrodes," a 36-page, letterhead-size illustrated catalog published by Wilson Welder & Metals supplies data on the proper electrodes to be used for all types of work on a wide variety of base metals and gives the approved welding procedure for each application. Electrodes are recommended for use on mild steel, alloy steels, low-alloy high-tensile steels and stainless steels and also for non-ferrous metals such as aluminum, aluminum bronze and manganese bronze. Chemical analysis, specifications and other engineering data are supplied for each type of electrode. **Wilson Welder & Metals Co.,** 60 East 42nd St., New York City 17.

» «

Pressure-Cylinder Bulletin

Bulletin A-103 (four pages, letterhead size) describes a new line of air and hydraulic cylinders being manufactured by the **Miller Motor Co.,** 4027-33 N. Kedzie Ave., Chicago 18. The 200 lb pressure air cylinders have steel heads and caps and brass cylinder walls, while the 1,500-lb hydraulic cylinders have solid steel heads, caps and walls. Separate interchangeable steel mountings are provided so that any cylinder can be adapted to different uses by simply changing the steel brackets. Mounting data on all models are given in the bulletin.

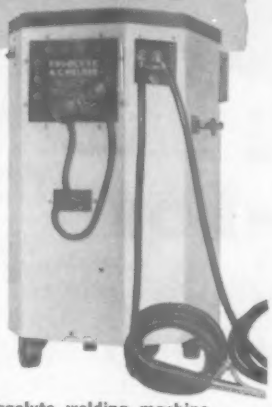
» «

Leaflet on Lighter

A single-page leaflet pictures and describes the "Randall" flint lighter for oxy-acetylene torches. **Welding & Cutting Materials Co.,** 400 East 18th St., Kansas City 8.

Meet the
MARQUETTE FAMILY
MARQUETTE A.C. ARC WELDERS
All jobs from light sheet metal to heavy steel structures are taken in stride. Alternating Current gives you "Balanced Polarity", Maximum Penetration and Metal Control . . . with No "Magnetic Blow". Versatile Marquette Welders are ideal for Maintenance or High Speed Production. 12 Models.
SEND FOR 24 PAGE ILLUSTRATED WELDER BOOKLET
ALL TYPES OF ELECTRODES And GAS WELDING RODS
"The Right Rod for Every Welding Job" is the key to Better Welding. The Marquette Laboratories' Know How has produced truly outstanding electrodes . . . leaders in the field. Each Rod is a masterpiece of modern metallurgical engineering, designed to help you do better work. Marquette also has a complete line of high quality Gas Welding Rods for every purpose.
MARQUETTE
GAS WELDING EQUIPMENT
A complete line of modern, high quality Gas Welding Equipment and Supplies. Advanced features are found in Marquette Welding and Cutting Outfits.
ACETYLENE GENERATORS
Save 70% of the cost of cylinder acetylene gas. Produces purer gas for a hotter, more uniform flame. 4 models, 12 to 50 pound capacity.
SEND FOR 24 PAGE GAS WELDING BOOK
And ALL WELDING
ACCESSORIES
Everything you need for Better Welding. Helmets, Welding and Power Cables, Electrode Holders, Arc Torch, Lenses, Spatter Shield and Fluxes. Your Marquette Distributor is Your Headquarters for the BEST in Gas and Electric Welding Equipment and Supplies.
MARQUETTE WELDING EQUIPMENT SOLD EXCLUSIVELY
THRU THE NATION'S LEADING DISTRIBUTORS
MARQUETTE
REGISTERED U.S. PAT. OFFICE
Welding
EQUIPMENT
A.C. ARC WELDERS · ELECTRODES
GAS WELDING And CUTTING EQUIPMENT
ACETYLENE GENERATORS · ACCESSORIES
MARQUETTE MFG. CO. INC.
MINNEAPOLIS 14, MINN.

AN AC ARC WELDER TO FIT YOUR NEEDS



251 or 161 WELDER
+
Whirlwind Air Cooling Assembly
+
Cyclone Automatic Arcing Assembly
=
EFFICIENT WELDING

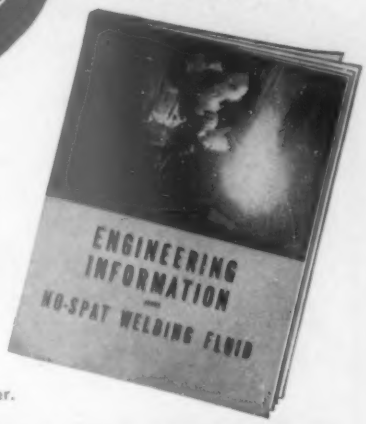
IT'S NEW. Start with a standard Ergolyte welding machine. As your requirements change, you can easily convert within a matter of minutes, a basic Ergolyte 251 or 161 welder to do continuous welding or quick arcing—or both. It's as simple as putting a new battery in your car. These machines have been top performers after 2½ years of testing. You'll find these PLUS FEATURES in combinations to meet your needs. Ergolyte welders are fast and economical to operate. Be equipped to do the BEST welding. PROMPT delivery. Write today.

A Few Jobbers Territories Are Still Open. We Welcome Your Inquiry.

ERGOLYTE Manufacturing Company
3627 N. LAWRENCE STREET—PHILADELPHIA 40, PENNA.

MINUTES SAVED ON EVERY WELDING OPERATION WITH NO-SPAT

THE NON TOXIC WELDING FLUID

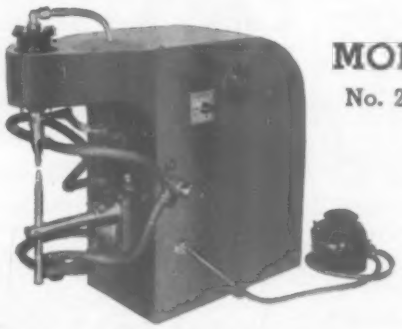


Saves cleaning time by keeping adjoining surfaces free of spatter. Maintains welding strength—⅓ less fumes—No carbon monoxide—Inexpensive—Ready to use—Saves labor—Saves Money.

Send for **FREE** Folder.

THE MIDLAND PAINT & VARNISH CO.
9110 Reno Ave. Cleveland, Ohio

WELDEX
ELECTRONICALLY TIMED SPOT WELDER



MODEL
No. 263-A

3 K.V.A.—220 Volts—60 Cycle
Single Phase—Air Operated—Bench Type

Solenoid Air-Valve, Foot-Switch Operated
Built in Electronic Timer
Adjustable Pressure Switch

For information and prices of spot, flash and butt welders write

WELDEX INCORPORATED
7339 McDONALD AVE. DETROIT 10, MICH.

Used in America's Leading Industrial Plants for the Past 10 Years!

PERMANENTLY REPAIRS DAMAGED GALVANIZED SURFACES-*good as NEW!*

USED BY SUCH INDUSTRIAL LEADERS AS:

DuPont, Swift, Electric Boat, New York Ship, Jos. P. Cattie & Son, U. S. Navy Yards, Hanlon-Gregory Galvanizing Co., Amer. Car & Foundry, many others.

Bonds perfectly and permanently to base metal without damage to surrounding galvanizing. Meets U. S. Army & Navy specifications, including 600 hour 20% salt spray test. Easily applied in few minutes by your own unskilled workmen. Costs only 2c to cover square foot. *Absolutely* guaranteed!

AMCO
GALVANIZING COMPOUND

MAIL THIS COUPON TODAY

AMERICAN SOLDER & FLUX CO.
2149 E. Norris St., Philadelphia 25, Pa.
Please mail us free Bulletin 52 giving full details on AMCO.

Individual .....
Name of Company .....
Street .....
City ..... State .....

Now! splice your WELDING CABLE

Easily — Quickly — without Soldering or Rigid Connections

with the

PUNCH-LOK

Streamlined

BANDING METHOD

Punch-Lok Clamp

Loking Tool

Punch-Lok Clamps and Loking Tool will splice that broken cable. You can tie, reinforce, connect, mend and make scores of other applications. Easy, fast, safe, economical. No normal pull strain can tear it loose. Punch-Lok Method will save you time and money.

Write for descriptive catalog and name of nearest distributor.

KEEP BUYING WAR BONDS

PUNCH-LOK COMPANY

Dept. E, 321 North Justine Street, Chicago 7, Illinois

Safe Welding

AT LOWER PRODUCTION COSTS

The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

Better Soldering, Annealing and Heating Jobs

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

WELDIT INC.

628 BAGLEY AVENUE • DETROIT 26, MICH.

Accessories Catalog

A 12-page price list and catalog (No. 130) of Airco arc-welding accessories has just been published. Equipment covered includes electrode holders, graphite electrodes, welding cable, cable connectors and lugs, welding helmets, goggles, face shields, headgear, aprons, gloves and sleeves. **Air Reduction Sales Co.**, 60 East 42nd. St., New York City 17.

» «

Gas-Holder Bulletin

A comprehensive picture of the design and construction of wet-seal gas holders is given in a new 52-page, letterhead-size bulletin (W-45). Engineering data are included on welding technique, pressure, painting surface, corrosion, dimensions, etc., of all sizes of gas holders up to 10,000,000 cu ft. Numerous cross-sections through the gas holder are shown, and the bulletin details construction methods from the laying of the bottom to the installation of the tank shell, holder sections and guide frame. Information tables on the operation and care of wet-seal holders are also included. **Stacey Brothers Gas Construction Co.**, 5535 Vine St., Cincinnati 16.

» «

Safety Tool Information

A data sheet, "Safety Tools of Ampco Metal," discusses a new line of safety tools made of Monel metal to supplement the present lines of aluminum-bronze and beryllium-copper tools. Monel metal tools, the bulletin states, should be used for work in connection with acetylene, oxygen, hydrogen, ammonia gas, carbon tetrachloride, magnesium hydroxide, natural gas, sodium nitrate, sulphuric acid (10-75%), turpentine, varnish, etc. In addition, the non-magnetic characteristics of Monel metal are said to make the alloy very desirable where magnetic disturbances must be avoided or eddy current effects minimized. **Ampco Metal, Inc.**, 1745 S. Thirty-Eighth St. Milwaukee 4.

» «

Conveyor Bulletin

"Spot conveying," the latest development in material handling, owes its name to a phrase from railroad parlance—"spotting" a car means to place it exactly where it can be loaded or unloaded to the greatest advantage. A flexible system that makes spot conveying possible anywhere in the industrial plant is described in an eight-page, letterhead-size booklet in two colors published by **Island Equipment Corp.**, 101 Park Ave., New York City 17.

» «

Elevating Table Bulletin

The various types of Lyon-Raymond hydraulic elevating tables are pictured and described in the company's new Bulletin 141 (six pages). **Lyon-Raymond Corp.**, 2551 Madison St., Greene, N. Y.

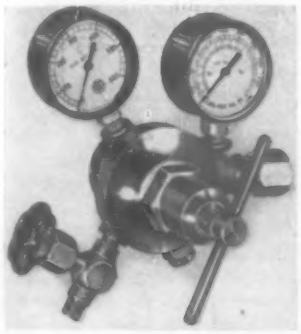
Locking "Slip-on" Renewal

an exclusive feature

The patented cartridge holding the spark metal locks exactly in correct position, permitting instant replacement. Get acquainted with the many other superior, exclusive features of Improved "Round File."

The Improved "Round File" Gas Lighter

SAFETY GAS LIGHTER CO. (Est. 1901) LYNN, MASSACHUSETTS



Nageldinger Style "N" 608 Regulator for delivery of pressures up to 500 lbs. p.s.i.

WE MANUFACTURE OXYGEN THERAPY APPARATUS • CYLINDER VALVES • CYLINDER MANIFOLDS • NEEDLE VALVE CONTROLS • WELDING AND CUTTING EQUIPMENT • PRESSURE REGULATING VALVES & REGULATORS • SAFETY VALVES • COMPRESSED GAS APPARATUS FOR: OXYGEN, HYDROGEN, NITROGEN, ACETYLENE, CARBON-DIOXIDE, HELIUM, ETC.

Send for 32-Page Catalog Featuring Welding and Cutting Equipment and Supplies.

JOHN NAGELDINGER & SON, INC.

Established 1880

Factory and Office at 409 E. 91st St., New York City 28, N. Y.

WELD-A-CAST Flux

The old brand is still the best

No. 1. For Welding with Cast Iron Rod.

No. 3. For Brazing and Bronze Welding.

No. 4. For Welding Cast Aluminum.

Ask Your Dealer—or write

CORTLAND WELDING COMPOUND CO.
Cortland, N. Y.

NEW LOW TEMPERATURE ELECTRODES

EutecTrode 28

A Coated Electrode for the Metallic Arc Welding of Bronze, Brass, Copper

For reduced production costs—can be used with AC and DC — deposits sound welds with good corrosion resistance — a close color match to red bronzes and yellow brasses—tensile strength 45,000 psi.

Bronze Castings welded with EutecTrode 28. This is the first electrode developed that can successfully weld copper, brass and bronze with an AC-DC metallic arc. Completely machinable, perfect color match, high tensile strength.

Take advantage of these improved EutecTrodes:

24—for cast iron—no preheat—AC-DC
24B—for cast iron—AC-DC
30—for copper—AC-DC
2100—for aluminum alloys—DC

and these EuteChroms:

2—for hard overlays on worn parts — AC-DC
4—for work-hardening overlays—AC-DC
6—for overlays on tool steel—AC-DC
8—for high hardness, impact strength — AC-DC
12—for extremely hard overlays—AC-DC

EUTECTIC WELDING ALLOYS CO., New York 13, N. Y.
Originators & Pioneers in Low Temperature Welding Rods & Fluxes

FREE Complete new booklet on fabricating with EUTECTIC Low Temperature Welding Rods.

"EITHEREND" CABLE CONNECTOR

Illustration shows connector apart with sleeves

BOTH ENDS EXACTLY ALIKE
Neither male nor female

Center illustration shows connector protected by the insulating sleeves pushed together and locked, ready for work: butt rubber sleeves make waterproof joint.

Lower illustration shows solderless type of connector without rubber sleeves. Made in sizes from 4/0 to #10 soldered and from 4/0 to #6 solderless.

Send for Bulletin 49A

Albert & J. M. Anderson Mfg. Co.

289-305 A St. • **Boston, Mass.**
NEW YORK CHICAGO PHILADELPHIA LONDON

Here's how *Welding* is slowed down

THERMACOTE COVER LENSES *Eliminate this*

WELD SLAG BOUNCES OFF

THERMACOTE special transparent plastic coating is impervious to weld spatter. No time lost changing glasses. Constantly clear vision insures better welding with more footage.

SLAG STICKS TO GLASS

As weld slag accumulates on cover glasses vision is reduced, production decreased and time lost with frequent changing of glasses.

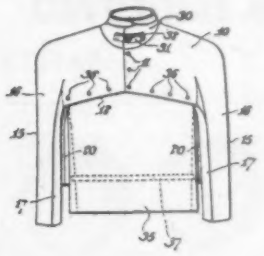
THERMACOTE CO.
NEWARK CHICAGO
LOS ANGELES PORTLAND

FROM THE PATENT OFFICE

Protective Cape

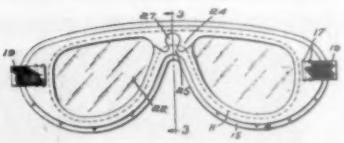
2,388,234. **George H. Abel,** Huntingdon Valley, Pa. Filed June 2, 1944. Issued Nov. 6, 1945.

Weldor's protective garment of fire-



resistant material comprising a yoke, sleeves and pendant side aprons. The yoke portion covers the shoulder and the upper portions of the front and back; the sleeves connect to the yoke, and the side apron portions extend downwardly from the armpits to protect the sides of the body. Each side apron has free side edges at the front and rear.

» «



Goggles

2,388,635. **Hugo M. Ditto,** Newton, Mass., assigned by mesne assignments to **Marine Optical Mfg. Co.,** Boston. Filed Dec. 15, 1942. Issued Nov. 6, 1945.

Goggles comprising a frame of flexible plastic material having a single opening for a one-piece flexible lens. The lens is received in a groove extending around the opening of the frame. Interlocking bridge members at the top and bottom sides of the frame embrace the central portion of the lens to hold it in position and strengthen the frame. A cushioning tube of compressible material is secured to the outer margin of the frame, and a head strap is connected to the ends of the frame.

» «

Copper Deoxidation Process

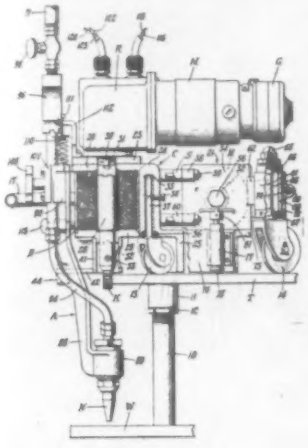
2,383,434. **Harry Le Roy Hovis,** Manor Township, Lancaster County, Pa., assigned to **Hamilton Watch Co.,** Lancaster, Pa. Filed Nov. 3, 1943. Issued Aug. 21, 1945.

A process for removing oxidation from beryllium-copper alloy by subjecting it to a bath of 85% pure phosphoric acid at a temperature of approximately 120 F in order to produce a surface that is capable of being plated.

Torch

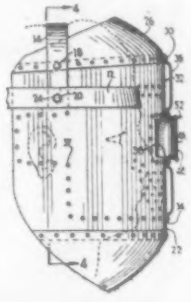
2,388,327. **Wilgot J. Jacobsson,** Plainfield, and **Lloyd W. Young,** Scotch Plains, N. J., assigned to **Union Carbide and Carbon Corp.** Filed April 16, 1941. Issued Nov. 6, 1945.

This patent pertains to a control device



in a hollow torch body with an opening extending through the wall to the outside. A stem is movable in the opposite direction from its normal position to operate the device; stem is pushed by the inner end of a trigger pivotally mounted on the hollow body on a fixed axis. Trigger has a flange portion in the opening of the body. A sealing member of resilient material is also located within the opening, between and in contact with the trigger flange and the outwardly facing shoulder in the opening. Surfaces of the sealing member sealingly engage portions of the trigger and the wall of the opening. The sealing member acts upon release of pressure from the trigger to restore the latter to its normal position, which in turn releases the stem to its normal position.

» «



Air-Supplied Helmet

2,388,604. **Merril Eisenbud,** Monsey, N. Y. Filed July 8, 1942. Issued Nov. 6, 1945.

This helmet includes a member which is maintained in a predetermined position in front of the wearer's face, the space between the member and the wearer being open to the outside atmosphere. Member has a plenum chamber to which air or other respirable medium is supplied under pressure through apertures in the wall of the chamber immediately in front of the respiratory orifices. The apertures in the wall of the chamber are so disposed that they will direct the respirable medium around and close to the respiratory orifices in such a way that the medium will strike the face and flow toward the outside atmosphere. The effect is to prevent the outside atmosphere from ever reaching the respiratory orifices.

» «

Rail-Testing Apparatus

2,388,683. **Royal E. Frickey,** San Francisco, and **Chester W. McKee,** Chicago, assigned to **Welding Service, Inc.,** Chicago. Filed March 26, 1941. Issued Nov. 13, 1945.

Apparatus for detecting flaws in railroad rails by magnetizing a length of rail and traversing a flux-responsive means over the rail ball. The flaws form flux fields which cause potentials to be induced in the flux-responsive means, and the potentials may be translated to form intelligible signals. A spotter coil is located adjacent the path of movement of the flux-responsive means. Movement of the latter past the spotter coil likewise causes a signal, and the position of the spotter coil along the rail may thus be adjusted to facilitate the exact location of a flaw.

HERCO VARIABLE CORE ARC WELDERS *for:*

MODELS FROM 150 TO 1500 AMPERES WITH OR WITHOUT POWER FACTOR CORRECTION

24 hour per day operation.
Exact heat control.
Increased production.
Lower power costs.
X-ray test welding.
Ease of operation.

Inquire about MAGNETIC CLAMPS for quick positioning and alignment.

HERCULES ELECTRIC & MFG. CO. INC.

MANUFACTURERS OF THE PRECISION WELDER WITH THE STREAMLINED ARC

2500 ATLANTIC AVENUE • BROOKLYN, N. Y.

#450

Metro Safety Equipment

A Sturdy Pair of PROFIT MAKERS

#650

Two of our Most Popular re-order HELMETS.

Equipped with American Optical Filterweld Lenses.

Compete Catalog and prices on request.

Distributors Wanted

METRO MANUFACTURING CO. Long Island City 1, N. Y.

reliably uniform

PQ Silicates

Maybe you know already what PQ quality means to uninterrupted production because you now use a PQ Silicate. But if you have never worked with PQ, it's a good time to get acquainted.

PQ uniform quality silicates are based on high standards scrupulously maintained from raw materials to finished products.

Counsel on the correct grades for your formulae on request.

PQ Silicates of Soda

MANUFACTURED BY PHILADELPHIA QUARTZ COMPANY
DEPT. A, 125 S. THIRD ST., PHILA. 6

W-AL-CO RODS
for Welding of ALUMINUM
ELECTRIC AND GAS WELDING

Drawn Wire
Types 2S, 43 and 52
Brazing 716

FOR CAST ALUMINUM

Use Extruded Rods
Types 142, 195, 355 and 356
for Better Welding
3/16" size only

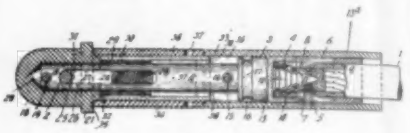
WELDING ALLOYS MANUFACTURING CO.
744 Broad St., Newark 2, N. J.

Underwater Cutting Circuit

2,387,042. **Eugen Seifried,** assigned to the **Government of the United States,** as represented by the **Secretary of the Navy.** Filed Oct. 12, 1921; renewed March 16, 1926. Issued Oct. 16, 1945.

Underwater cutting circuit comprising a pair of submerged electrodes, means to apply a low d-c potential to them, means to balance the electromagnetic effect associated with the low potential, means automatically responsive to unbalance of the electromagnetic effect to cut off the low potential and apply high potential, means to cut off the high potential after a predetermined time.

» «

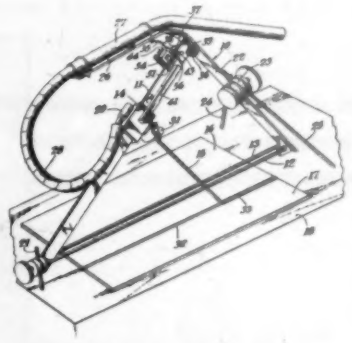


Electrode Holder

2,387,464. **Charles A. Palmgren,** Chicago. Filed Oct. 18, 1943. Issued Oct. 23, 1945.

In an electrode holder, the combination of a body member with a transverse bore for holding an electrode at one end. An elongated longitudinal slot in the body member merges with the electrode bore; the slot contains an electrode-clamping jaw that is movable toward and from the electrode bore. The movable jaw is actuated by an internal threaded connection with a rotary tubular sleeve that surrounds the slot and movable jaw.

» «



Gravity Arc Welder

2,387,864. **Joseph M. Tyrner,** New York City, assigned to **Air Reduction Co., Inc.,** New York City. Filed Dec. 4, 1944. Issued Oct. 30, 1945.

A gravity-feed, semiautomatic arc-welding apparatus including a frame and slide part. The frame is supported on edge with the slide part inclined to the workpiece. The electrode holder is slidable down the slide part until the electrode extends into engagement with and rests upon the workpiece. An arc-starting device extending between the frame and electrode holder is adapted to lift the holder and electrode on the slide in order to draw an arc.

The NEW, IMPROVED Variable-Core type

GREYHOUND

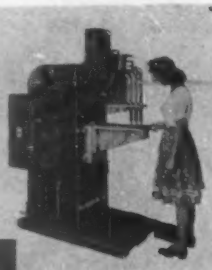
A. C. Arc Welders Provide LOWER OPERATING COSTS for HEAVY DUTY PRODUCTION

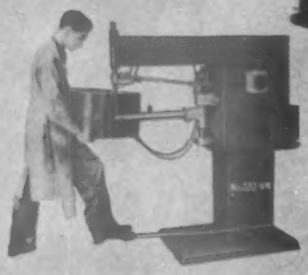
Detailed information and prices sent on request

Distributors Wanted

GREYHOUND A. C. ARC WELDER CORP.
Manufacturers
520-28 Morgan Ave., Brooklyn 22, N. Y.

SPOT • BUTT • ARC
WELDERS





AIR, FOOT or MOTOR Operated Press Type Welders of All Sizes.

We manufacture a complete line of resistance spot welders from ¼ to 300 KVA for all types of welding. There is an EISLER WELDER for every purpose.

Transformers of all types.

We invite contract spot welding in large or small quantities.

Write for Catalog

EISLER ENGINEERING CO.

Address: 749 So. 13th St., (near Avon Ave.), Newark 3, N. J.

METAL BOND
METAL BOND MFG. CO. ST. LOUIS, U.S.A.

METAL BOND

Welding and Brazing Fluxes are Quality Products

SEND CARD FOR OUR A-4 CATALOG

All Metal Bond products are sold on—"The user must be satisfied or he returns unused portion in original package for 'Money Back'."

METAL BOND MANUFACTURING CO.
3201 Kossuth Avenue — St. Louis 7, Missouri

WELDON ROBERTS

Brightboy

GRIND TO BUFF — ONE OPERATION
Saves Time and Improves Work With Simultaneous

- BURRING
- FINISHING
- POLISHING

BRIGHTBOY INDUSTRIAL DIVISION
Weldon Roberts Rubber Co.
Newark 7, New Jersey

Designed especially for weldors' use

WHEELRITE All-Welded CYLINDER TRUCKS

Meet all tank handling requirements

For Safe, Easy handling and transporting of tanks for jobs in both shop and field, use dependable WHEELRITE All-Welded Cylinder Trucks. Sturdy all-welded angle iron framework — Hefty one-piece tubular steel handles — Large, wide flanged easy-rolling steel wheels.

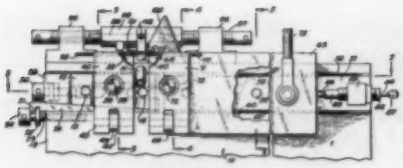
Available in three sizes to provide for every type cylinder and unit used in welding.

Illustrated: Wheelrite No. 1 — Provides for the two largest size tanks of oxygen and acetylene. 18 inch wheels.

Send for illustrated circular.

Distributors wanted.

Weldrite Co., Inc. Mfrs. *(Established 1908)*
29-23 40th Road, Long Island City 1, N. Y.



Butt Welder

2,387,067. **Herbert P. Heath,** Riverside, and **Keith A. Weston,** Chicago, assigned to **Western Electric Co., Inc.,** New York City. Filed May 13, 1943. Issued Oct. 16, 1945.

An apparatus for butt welding rods or wires. Relatively fixed clamping jaws clamp one wire or rod, and relatively movable jaws clamp the other in alignment with it. The movable jaws are supported for movement toward and away from the fixed jaws. A gauge, movable to position between the rods held by the jaws, has an adjustable abuttment member to position the movable jaws.

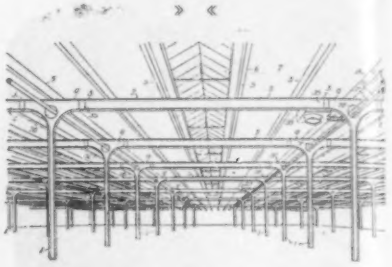
» «

Template-Following Machine

2,388,376. **Lloyd W. Young,** Elizabeth, N. J., assigned to **Union Carbide and Carbon Corp.,** New York City. Filed June 3, 1943. Issued Nov. 6, 1945.

A template-reproducing machine comprising a carriage having castors adapted to ride on the template and follow its contour. Guide rolls on the carriage are located at positions divergently outward from the template-following means. A means for reproducing the contour is aligned with the contour-following means.

» «



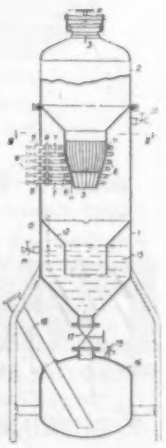
Welded T-Head Columns

2,387,134. **John Jay Fox,** Chicago. Filed Jan. 16, 1941, and Dec. 21, 1943. Issued Oct. 16, 1945.

A method of forming a built-up T-head column. The webbing between the side flanges of an H-beam column is cut away for a distance measured downwardly from the upper end of the column, and the side flanges on opposite sides of the column are bent outwardly for substantially the distance of the cutaway web portion. A substantially T-shaped plate is then formed with opposed arcuate side edges to fit into the opening between the bent flanges. The plate is positioned so that its lower end seats upon the upper edge of the uncut webbing in the column and the bent out flanges of the column rest against the arcuate side edges of the plate. The flanges are welded to the arcuate side edges, and a top flange is welded along the upper edge of the plate.

» «

Acetylene Generator



2,387,462. **Karl Sixten Jöns Nordholm,** V. Bodarne, Sweden, assigned to **Aktiebolaget Svenska Carbidkontoret,** Gothenburg, Sweden. Filed Dec. 4, 1943. Issued Oct. 23, 1945.

An acetylene generator comprising in combination a perforated carbide receptacle, a water conduit and a number of annular tubes connected to the conduit and arranged one above the other around the receptacle. These tubes have nozzle openings for sprinkling water against the perforated receptacle. A gas-tight covering surrounds both the receptacle and the nozzle tubes; water and gas outlets extend from this covering. The height of the carbide receptacle considerably exceeds the width of its bottom, and a plurality of independently operable valves control the flow of the water through the nozzles.

SKILGRINDERS are built with powerful, smooth running motors for high load speed on all bead grinding, filing and buffing jobs . . . ball bearings in steel inserts on armature and extreme end of spindle shaft to absorb thrust and eliminate vibration . . . commutators, brushes and switches fully enclosed against dust for longer, trouble-free service. Ask your distributor today for a demonstration on your own work.

SKILSAW, INC.
5033-43 Elston Ave., Chicago 30, Illinois
Factory Branches in All Principal Cities

PLANNING RETOOLING?

Let SKILTOOL Field Engineers help you now to plan "tooling-up" for more efficient and economical peacetime production with SKILSAW'S new postwar tools.

NOW!
This New Low-Cost Aid For WELDING

Cost records prove it! The P&H WP-2 Welding Positioner speeds up welding — cuts costs on all kinds of jobs. It's the most versatile — the easiest to operate positioner — is available now at a cost that will surprise you! Get all the facts . . see how the P&H WP-2 will fit in your welding picture — to save all along the line.

- 2,500-pound capacity
- Surprisingly low cost
- Versatile — handles all kinds of jobs
- Simple and easy to operate
- Manual, handwheel for power table turning
- Easy-working telescopic elevation
- Hydraulic power table tilting
- Large table area — with handy slots
- No exposed gearing
- Portable or column-in-floor mounting
- Plus many other time, money-saving features

Model WP-2 — 2500-pound capacity.

Write for free bulletin P2-1. Other models up to 36,000 pounds capacity.

General Offices:
4513 West National Avenue, Milwaukee 14, Wis.

HARNISCHFEGER CORPORATION

DESIGN PRODUCTS FOR RESISTANCE WELDING . . . IT PAYS

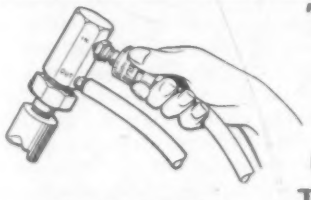
An axiom of the Resistance Welding field is, "Almost any metal product can be Resistance Welded, *if it is designed for Resistance Welding.*"

Poor design in a product reduces the resultant efficiency of Resistance Welding. Proper design means that a product can be joined by Resistance Welding faster, cheaper and stronger than by any other method. Equally important is the design of the Resistance Welding tip used on the job. To be efficient it must be of the proper alloy, correct in shape and adequately cooled.

To make available these important Tip features is the job of S-M-S...suppliers of "Unusual Alloys for Unusual Applications".

S-M-S CORPORATION
1165 Harper Ave., Detroit 11, Mich.

Manufacturers of:
EJECTOR TYPE ADJUST-A-COLD HOLDERS, SEAM WELDER WHEELS, PROJECTION and FLASH WELDER DIES, SPECIAL ALLOY FORGINGS and CASTINGS
"Unusual Alloys for Unusual Applications"



SHUT OFF COUPLER

"ELECTROLOY" for RESISTANCE WELDING

Butt
Flash
Spot
Seam
Projection

ELECTROLOY

Catalog and Prices on Request

FLASH WELDER WITH INSERT

THE ELECTROLOY CO. INC. 1600 SEAVIEW AVE. BRIDGEPORT, CONN.

- Oxy-Acetylene Rods and Fluxes
- Welding & Cutting Torches
- Pressure Regulators
- Arc Welding Electrodes
- Helmets Goggles Lenses
- Welders' and Work Gloves

Special Welding Alloy Co., Inc., 27-33 Jackson Ave., Long Island City 1, N. Y.

Fluxes cost SO LITTLE yet are SO IMPORTANT

Use only those GOOD Guaranteed

"ANTI-BORAX"
FLUXES

No. 1 Cast Iron Welding Flux.
No. 2 Brazing Flux for Brass, Bronze, etc.
No. 4 "Braz-Cast" Flux for Bronze Welding Cast Iron.
No. 5 Aluminum Flux for Cast Aluminum.
No. 8 Aluminum Flux for Sheet Aluminum.
No. 9 Stainless Steel Welding Flux.
No. 11 Tinning Compound.
No. 16 Silver Solder Paste Flux.

Send for Free Samples

MANUFACTURED ONLY BY
ANTI-BORAX COMPOUND CO., Fort Wayne, Ind.

HOBART *Arc Welding School*
trains quickly, thoroughly

Classes for MEN *and* WOMEN

Hobart's school is not a war-time offspring. Established long before the war to give experienced operators to the fast growing business of arc welding. ***Instructors Are Expert Welders...*** and they are expert teachers, too. They've all had years of experience showing others the correct procedures of every type of welding.

Send Your Men to Hobart
Many plants send men and women to increase their welding operations.

Write Today FOR LITERATURE

HOBART TRADE SCHOOL
Box U-161, Troy, Ohio

The Wheels of Industry Turn Again!
– Breaks are welded with

SHAWINIGAN CARBIDE

SHAWINIGAN PRODUCTS CORPORATION
1317 EMPIRE STATE BLDG., 350 FIFTH AVE., NEW YORK 1, N.Y.

"SAF-T" CURTAINS for Industrial Uses

Made of fine quality, heavy flame-proof duck.
Any size required.
Equipped with grommets ready to hang.
Color: Olive Drab.
SOLD THROUGH YOUR LOCAL JOBBER

FRED JESSAR
404 Denckla Bldg. Philadelphia 7, Pa.

Write for prices and descriptive material.

"Jorgensen"
CLAMPS
FOR WELDERS
"Jorgensen"
Extra Quality
Series 120 Body Clamps. A large variety of "C" Clamps and Bar Clamps to choose from—
Send for Catalog No. 16
Ask for them by name—
ADJUSTABLE CLAMP CO.
"The Clamp Folks"
426 N. Ashland Ave., Chicago 22, U. S. A.

HARGRAVE TESTED CLAMPS
INDIVIDUALLY TESTED
- WELDING
- DEEP REACH
- QUICK ACTING
- FORGED STEEL

Write for new catalog showing a clamp for every purpose.
Ask your supply house
The Cincinnati Tool Co.
1944 Waverly Ave. Cincinnati 12, O.

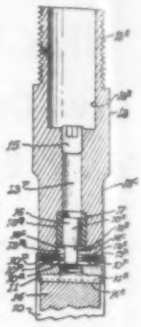
for Easier CAST IRON BRAZING

1 Fear of overheating can be forgotten.
2 Cleaning and grinding are unnecessary, because it penetrates through grease, oxides, etc.
3 Chipping is unnecessary. A satisfactory bond can be obtained on oxidized surfaces.
4 Deteriorated cast iron can aways be welded with "York's 77".

YORK ENGINEERING COMPANY
3349 OGDEN AVENUE CHICAGO, ILLINOIS

YORK'S 77
CAST IRON BRAZING FLUX

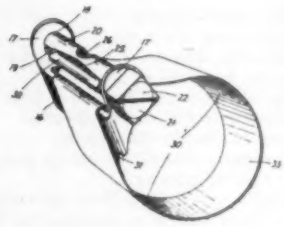
Spot-Welding Electrode



2,387,905. **Joseph Hoeh,** Congress Park, Ill., assigned to **Witlek Mfg. Co.,** Chicago. Filed May 15, 1944. Issued Oct. 30, 1945.

A spot-welding electrode having a slotted work-engaging end divided into a plurality of flat contact faces. A pilot, mounted in and electrically insulated from the body of the electrode, extends through the slotted portion outwardly beyond the contact faces.

» «

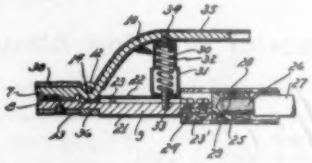


Pipe Clamp

2,388,371. **Olof Staff,** Princess Bay, N. Y. Filed Nov. 4, 1943. Issued Nov. 6, 1945.

A pipe-clamping device consisting of a frame comprising a metal cross bar and lateral portions having circular bearing openings. A spindle with a squared head extends through both bearing holes so that the square head will engage one of the lateral portions. The other end of the spindle is flanged against the other lateral portion. The spindle is longitudinally split into two equal sections, one of which is cut out for the insertion of a flexible strip adapted to be wound on the spindle. The end of the metal strip exerts internal pressure to separate the spindle sections in order to increase the frictional engagement with the lateral portions.

» «



Electrode Holder

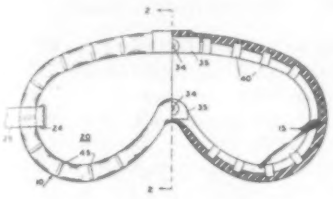
2,387,888. **Thomas S. Donnelly, Jr.,** Detroit, assigned to **Bordon Mfg. Co., Inc.,** Detroit. Filed Feb. 19, 1943, and March 10, 1945. Issued Oct. 30, 1945.

An electrode holder having a supporting prong with an electrode-engaging jaw. A pair of spaced lugs project from the prong and support a pivot member on which is mounted a coöperating clamping jaw. The outer faces of the lugs are insulated, the insulating means and the pivot member being secured in operative position relative to the lugs.

Goggles

2,387,851. **Walter Lown,** Boston, and **Charles A. Baratelli,** Cambridge, Mass., assignors by mesne assignments to **American Optical Co.,** Southbridge, Mass. Filed Feb. 3, 1942. Issued Oct. 30, 1945.

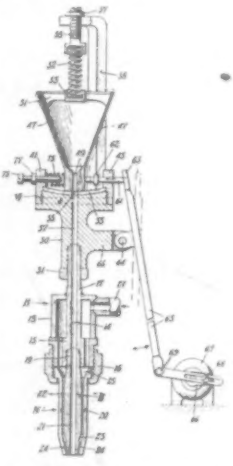
A single-aperture goggles frame com-



prising a semiflexible front rim having a softer, face-fitting rear rim molded along its outer edge. A readily removable flexible lens is secured within the channel formed between the front and rear rims.

» «

Hard-Facing Apparatus



2,389,702. **Valentine G. Ullmer,** Pittsburgh, assigned to **Haynes Stellite Co.,** a corporation of Indiana. Filed April 1, 1943. Issued Nov. 27, 1945.

Apparatus for applying welded-on overlays of protective metal upon a metal surface. It comprises a torch having a nozzle provided with a passage for finely divided solid material. Torch is equipped with a means for feeding the finely divided solid material to the oxy-fuel gas passage and its discharge outlet. The feeding means includes a support for the material having a discharge passage and an apertured plate; support and plate are movable relative to each other. Relative movement between the support and plate is effected transversely of the discharge passage, whereby intermittently and recurrently the aperture in the plate and the outlet passage in the support are both in communication with the passage for solid material in the torch nozzle.

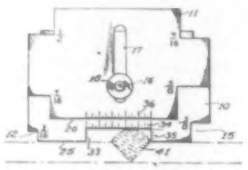
» «

Flame-Cutting Machine

2,389,585. **James L. Anderson,** Closter, N. J., assigned to **Air Reduction Co., Inc.,** New York City. Filed Feb. 24, 1943. Issued Nov. 27, 1945.

An improvement for a plate-cutting or welding machine having a pair of self-propelled motor-driven carriages traveling on parallel tracks. A bar spans the two carriages and is swivelly connected at one end to one of them. An arm swivelly connects the other end of the bar to the second carriage. The torch is carried by the bar. The second carriage carries an adjustable speed-control governor and means to adjust it. The improvement comprises a lever pivoted on the second carriage and operatively connected at one end to the governor-adjusting means. Upon canting of the bar due to the carriages moving out of transverse alignment, the lever is swung about its pivot and thereby actuates the governor-adjusting means.

» «

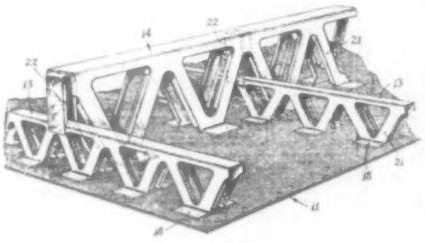


Welding Gauge

2,389,842. **William H. Cummins,** Portland, Ore. Filed April 26, 1943. Issued Nov. 27, 1945.

This gauge has a pair of superimposed plates of the same length and width. A rectangularly shaped opening is cut in the edge of one plate to fit over a weld bead. The effective depth of the cutout section as a bead gauge can be modified by adjusting the relative position of the plates so that the corresponding edge of the other plate will block off the upper part of the cutout section.

» «



Welded Structural Frame

2,389,767. **Nelson W. Dalton,** Moorestown, N. J., assigned to **Edward G. Budd Mfg. Co.,** Philadelphia. Filed Sept. 1, 1943. Issued Nov. 27, 1945.

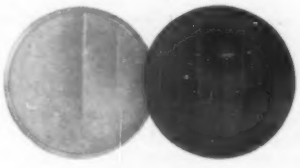
A strong, light and rigid skin sheet-and-frame construction for aircraft and the like. A U-shaped beam has a continuous plate as the back of the U, and side webs are integral with the back plate and have inclined struts and lightening openings between them. The struts on each side are joined in pairs at apices opposite the back plate. The struts on the two sides are coaxially arranged in pairs, and the alternate openings of each side web extend through the side of the beam opposite the back plate. Outturned feet on the strut apices are spaced apart longitudinally and transversely; the spaced feet are spot welded to a skin sheet.

"Things will look up, when you start using

COLONIAL GLOVE AND GARMENT SPLITS

THEY INSURE THE MAXIMUM OF COMFORT... safety... and durability. All weights for men and women welders' gloves and garments, in large spread whole kips and side splits. Samples.

COLONIAL TANNING CO.
Glove and Garment Leather Division
MILWAUKEE, WIS.



W-AL-CO
COVER LENSES

for Gas Welding.
Spatter-resisting or plain.

GOGGLE LENSES (50 mm)

Protect Your Vision with the Best in Lenses and Plates

WELDING ALLOYS MFG. CO.
744 Broad St., Newark 2, N. J.

W-AL-CO

SUPER-PLATE FILTER LENSES for Helmets and Handshields.

Resistance-Welding Circuit

2,388,430. **George S. Mikhalapov,** Media, Pa., assigned by mesne assignments to **The Taylor-Winfield Corp.,** Warren, O. Filed Dec. 13, 1940. Issued Nov. 6, 1945.

A circuit for resistance-welding apparatus of the electromagnetic stored-energy type having an inductive reactor and a secondary welding circuit. The circuit covered in the patent is designed to apply direct current to the reactor; it comprises a circuit-opening means to interrupt the flow of current through the reactor, means to control the rate of rise of the welding current in the secondary circuit and a resistance connected across the circuit-opening means to control the rate of decay of the current induced in the welding circuit. The means for controlling the rate of rise of the welding circuit comprises a capacitance in parallel with the reactor.

» «

Goggles and Eyeshade

2,385,405. **Bayard H. Crowther,** Wyncote, Pa., assigned to **Bachmann Brothers, Inc.,** Philadelphia. Filed July 14, 1943. Issued Sept. 25, 1945.

An eyeshade and goggle combination in which the goggle elements are hingedly connected by a fabric strip. The eyeshade is divided into halves, which are hingedly connected by a fabric strip and also hingedly connected to the goggle elements. Snap fasteners on the goggle elements are complemented by snap fasteners on the halves of the eyeshade.

» «

Respiratory Mask

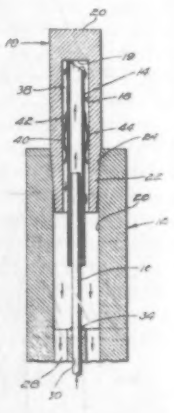
2,389,102. **Benjamin F. Williams,** Salem, Ore. Filed July 14, 1943. Issued Nov. 13, 1945.

A respiratory mask comprising a

resilient one-piece wire frame, opposite ends of which define a pair of bows. The intermediate U-shaped portion of the frame depends substantially at right angles from the bows. The upper ends of the legs of the U-shaped frame portion are joined to the bows by inturning frame portions. A mask unit comprising a plurality of layers of flexible material is secured by the insertion of the U-shaped frame portion between the layers. The inturned frame portions fit under opposite corners of the pocket between the layers to retain the mask firmly in place.

» «

Cooled Electrode Tip



2,388,587. **Thomas A. Wilson,** Stratford, Conn., assigned to **United Aircraft Corp.,** East Hartford, Conn. Filed July 18, 1944. Issued Nov. 6, 1945.

A spot-welding electrode comprising an open-ended tubular body with a hollow tip having one closed end. The open end of the tip is removably connected to the open end of the tubular electrode body. The means for circulating cooling fluid within the body and tip includes an axially disposed tube fixed to the body and terminating adjacent its open end and a coöperating axially disposed tube carried by the tip. One end of the latter tube terminates adjacent the closed end of the tip and the other end telescopes within the tube in the electrode body. The tip-carried tube is positioned in the fluid-circulating position relative to the tip during removal and insertion of the latter in the electrode body.

ru'tile, 1. rū'til, 2. ru'til, n. Mineral. An adamantive, reddish-brown, transparent to opaque tetragonal titanium dioxid (TiO_2), usually containing a small quantity of iron (F., shining, L. rutilus, red) ru'til.

SYNONYM

Ruflux

TAMCO is . . . and has been for a number of years . . . the largest supplier of titanium compounds used in welding rod formulation, such as rutile, potassium and sodium titanate. We also furnish alloys such as 40% low carbon ferro titanium, nickel and manganese titanium and compounds such as zircon, potassium zirconate, zirconium oxide, etc., for special coating formulation. Manufacturing operations covering these compounds are carefully controlled, and uniform products are assured at all times.

1. Ruflux 61—A 93% to 95% TiO_2 containing rutile milled to from 0.5% to 1½% on a 200 mesh screen. Major impurities are SiO_2, $ZrSiO_4$, Fe_2O_3 and FeO. Injurious impurities such as S. and P_2O_5 are kept to a minimum.

2. Ruflux 84—A 93% to 95% TiO_2 containing granular rutile of similar analysis to Ruflux 61. This coarser rutile is used to avoid coating dry cracking.

3. Ruflux P—A potassium titanate containing approximately 73% TiO_2 and 19% K_2O. This compound is used for arc stabilization purposes and contains no injurious impurities. Ruflux P is milled to approximately 4% on a 200 mesh screen.

4. Ruflux S—A sodium titanate containing approximately 80% TiO_2 and 15% Na_2O. Another arc stabilizer and formulated to reduce hycroscopic action to a minimum.

5. Ruflux Z—A zirconium silicate containing approximately 65% ZrO_2 and 34% SiO_2 combined as $ZrSiO_4$. The compound is milled to 0.10% on a 325 mesh screen and due to its high melting point (3850° F.) is used as a slag stiffener.

6. Ruflux P. Z.—A potassium zirconate, containing 80% to 81% ZrO_2, 14% to 15% K_2O, 3% to 4% SiO_2 and smaller percentages of TiO_2, Fe_2O_3, CaO, etc.

7. Ruflux T—A zirconium oxide containing from 90% to 91% ZrO_2, 5.00% SiO_2, 0.80% Na_2O and lesser percentages of TiO_2, CaO, Al_2O_3, etc. Ruflux T is milled to 0.1% on a 325 mesh screen.

8. 40% Low Carbon Ferro Titanium—containing from 38% to 42% Ti., 3% to 5% Si., 6% to 9% Al., 1% to 2% Cr. The alloy is milled to minus 80 mesh.

9. Tam Nickel Titanium—contains from 25% to 28% Ti., 60% to 65% Ni., 6 to 8% Al., 2% to 4% Si., and 2% to 5% Fe. The alloy is milled to minus 80 mesh.

10. Tam Manganese Titanium — contains from 27% to 29% Ti., 35% to 40% Mn., 20% to 25% Fe., 7% to 9% Al and 2% to 4% Si. The alloy is milled to 80 mesh.

Tamco also manufactures alloys such as Ferro Carbon Titanium, Bortam and boron containing titanium alloys, and various other titanium and zirconium compounds.

It pays to include these compounds in your welding rod coating formulation research.

A reasonable series of tests in your own plant will indicate the superiority of RUFLUX.

THE TITANIUM ALLOY MANUFACTURING CO.

Executive Offices: 111 Broadway, New York, N. Y. *General Offices and Works:* Niagara Falls, N. Y.

Electrode Holder

2,387,169. **Roy C. Morford,** Manassas, Va. Filed Aug. 13, 1943. Issued Oct. 16, 1945.

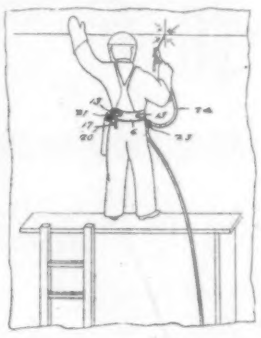
An electrode holder comprising an insulated handle, a tubular conductor disposed within the handle, a plunger operating within the tubular conductor, an open-ended head tiltably mounted on one end of the tubular conductor, means for urging the plunger into the head. The electrode is clamped between the beveled end of the plunger and the head.

» «

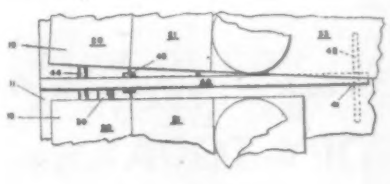
Belt for Accessories

2,388,811. **Michael Zatko,** Oaklawn, Ill. Filed Feb. 25, 1944. Issued Nov. 13, 1945.

A weldor's belt comprising a body having separable fastening means at its end. The intermediate rear portion of the body is wider than its end portions and serves as a back support. A vertical strip extends transversely of the body and is secured at its ends to upper and lower portions of the latter. A horizontal strip extends longitudinally of the body and has one end secured to the latter and the other end extending under the vertical strip. A fastener passes through overlapped portions of the strip and body, and article-holding rings are loosely engaged about the vertical strip above and below the horizontal strip.



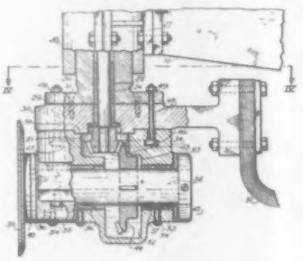
» «



Butt Welder

2,387,112. **William Ogle Bennett, Jr.,** Lancaster Township, Lancaster County, Pa., assigned to **Hamilton Watch Co.,** Lancaster, Pa. Filed Sept. 4, 1942. Issued Oct. 16, 1945.

This apparatus for butt welding fine wires includes a stationary vise secured to a base and a movable vise pivoted on the base. Each of these vises has a stationary and a movable jaw, the movable jaws being forced by a cam means against their respective stationary jaws against the force normally exerted by springs. A tongue on each of the movable jaws enters a groove formed on each of the stationary jaws to lock the wires in the desired position. The stationary vise and the pivoted vise are aligned so that at one position of the latter the grooves of the stationary jaws are in vertical alignment. A gauge removably positioned between the movable and stationary vises initially receives the ends of the wire to properly position the wire in the grooves. The stationary jaw of the stationary vise carries a stop pin engaging the stationary jaw of the pivoted vise to support the latter vise in the groove-aligning position. The stop pin limits the motion of the movable vise toward the stationary one during welding.



Seam Welder

2,389,034. **Charles Eisler, Jr.,** Maplewood, N. J., assigned to **Eisler Engineering Co.,** Newark. Filed Feb. 18, 1944. Issued Nov. 13, 1945.

Elements of this seam welder are a support, a slide bearing secured to the support, a ram positioned in the slide bearing, means to clamp the bearing on the ram, a flange on the ram, a turret holder, a boss on the holder, means to secure the flange to the turret holder, and a turret having a recessed portion for complementary engagement with the boss. The welding wheel is secured to the turret. The turret has a circular slot of T cross section communicating with a gate of T cross section. Bolts are positioned in the slot through the gate. A means engaging the bolts and ram flange locks the parts together and enables the turret to be rotated on the bolts when the engaging means is loosened.

» «

Thermit-Welding Application

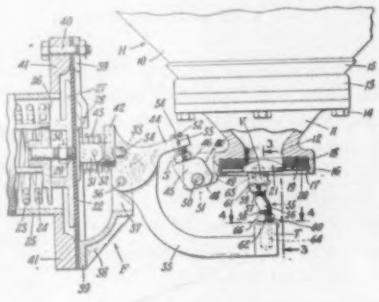
2,387,715. **Charles A. Cadwell,** Cleveland Heights, O., assigned to **The Electric Railway Improvement Co.,** Cleveland. Filed Aug. 8, 1942. Issued Oct. 30, 1945.

Thermit welding of bonds to railway rails by means of the exothermic reaction between an oxide of a metal having a lower melting point than iron and aluminum. The patent covers the inclusion in the reaction mixture of sufficient metallic iron to reduce a substantial part of the oxide.

Acetylene Generator Valve

2,387,347. **Ralph C. Pierson,** Indianapolis, assigned to **Union Carbide and Carbon Corp.,** New York City. Filed May 1, 1943. Issued Oct. 23, 1945.

The combination of an annular valve seat, valve and valve-operating device. The valve is connected with the valve-operating device by a crank having one portion with an axis concentric with the center of the valve seat and another portion with an axis eccentric with the center of the seat. One of these crank portions is connected to the valve eccentrically, and the other crank portion is connected with the valve-operating device so that the valve may be adjusted into axial alignment with the annular valve seat.



» «

Electrode Holder

2,386,080. **Ingvart J. Andersen,** Oakland, Calif. Filed April 26, 1943. Issued Oct. 2, 1945.

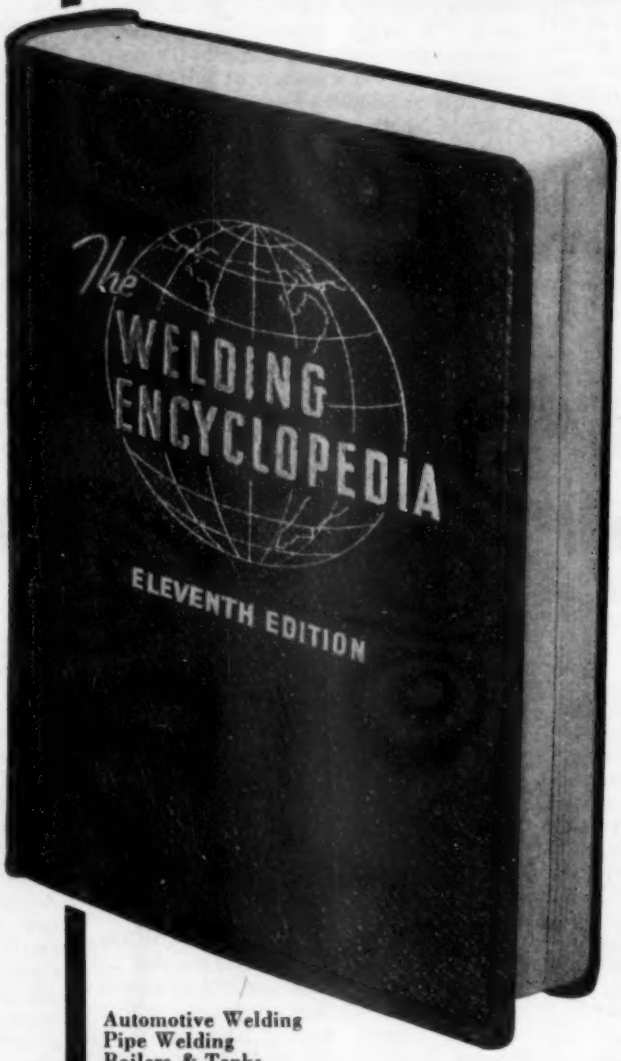
An electrode holder having a tubular base open at its upper and lower ends and a centrally disposed stem member rigidly secured at its lower end within the base element. The upper portion of the stem projects upwardly and extends beyond the upper end of the base. A tubular cap element houses the upper portion of the stem and is adjustably secured to the base. A bearing plug arranged within the upper end of the cap is adapted to coöperate with the upper end of the stem to clamp a welding rod therebetween when the tubular cap is adjusted relative to the base. Supply cable is secured to the lower open end of the tubular base.

Patents Available for Licensing or Sale

2,010,364. **Converter.** Issued Aug. 6, 1935. A synchronous commutator device which modulates and interrupts commercial-frequency alternating currents. Primarily a frequency changer to raise frequency from 60 to 120 cycles or lower it from 60 to 30 and 15 cycles, the principal use of this device was found to be in the control of seam welders. Commercial test data are available from the inventor. (Owner) **Fielder I. Hiss,** 327 Second St., N. E., Washington 2, D. C.

NOW—NEW

THE 11th EDITION of the WELDING ENCYCLOPEDIA



One of the greatest values ever presented by a major reference book—980 pages of current authoritative information with 1359 illustrations on the world's most important and fast developing industrial process — Welding.

$6

• *Completely Re-Written —Up-to-the-Minute*

The 11th Edition of The Welding Encyclopedia comes to you completely re-written—reflecting the tremendous changes in welding wrought by the production necessities of American Industry at war. In its 22 years of service to the Welding Industry no single edition of The Welding Encyclopedia has presented so much completely new and vital information on welding practice. Edited and rewritten by T. B. Jefferson, leading technical editor and engineer, this complete reference book is a *must* on the list of every engineer and weldor.

• *25% Larger— 980 Pages— 1359 Illustrations*

The 11th Edition is a 25% larger volume—completely re-written. It is rearranged with easy-to-find cross-references and contains 1359 illustrations in its 980 pages. It brings to you, in its added size, a complete compilation of exhaustive research keyed to the demands of Industry's fastest growing fabricating process. It contains compact authoritative data—much of which can be found only in The Welding Encyclopedia, 11th Edition.

• *Every Major Field— 2000 Subjects*

Arc Welding
Gas Welding
Resistance Welding
Heliarc Welding
Atomic Hydrogen
X-Rays
Gamma Rays
Magnetic Inspection
Flame-Hardening
Metallizing
Heat Treatment
Flame-Cutting
Metallurgy
Aircraft Welding
Shipbuilding
Automotive Welding
Pipe Welding
Boilers & Tanks
Structural Welding
Training
Eye Protection
Safety Practice
Railroad Equipment
Agricultural Implements

Covering more than 2000 subjects, completely indexed and cross-referenced—the 11th Edition of The Welding Encyclopedia gives up-to-the-minute complete coverage on every major phase of welding.

Everything in Welding Complete in One Book . . . Everyone Needs It

ORDER YOUR COPY TODAY

for

INDISPENSABLE • COMPLETE • UP-TO-DATE

INFORMATION ON WELDING

The Welding Engineer Publishing Co.
Division of McGraw-Hill Publishing Co. Inc. (146)

506 So. Wabash Avenue
Chicago 5, Ill.

Please enter my order for: (Please check)

☐ The Welding Encyclopedia.....$6.00

☐ The Welding Encyclopedia and The Welding Engineer for 1 year, a saving of $1.50 (a one year subscription to The Welding Engineer is $3.00).....$7.50

My check ( ), money order ( ) is enclosed.